

Time and Tide: Ecological Transformation and Restoration on Scotland's Coastline

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In 2006, a new record label was established to distribute the Scottish folk music of husband and wife team, Julie Fowlis and Éamon Doorley. Fowlis, who was featured on the soundtrack for Disney's *Brave*, is likely the most famous Scottish Gaelic musician in the world. Described as a "quiet torchbearer for her native tradition," her pure and evocative voice has brought the songs of her childhood North Uist home to the masses.¹ The connection to her Hebridean roots is apparent in the name of the label that produces her work: Machair Records. A distinctive type of coastal grassland, machair is a landscape found exclusively in the north and west of Scotland and Ireland. This habitat is shaped and supported by crofting communities, which, in turn, are strongly associated with Gaelic culture in the Hebrides. Yet, as Machair Records explains, "it is a fragile environment which is under threat, a little like the music which is produced on this label."² Thus, just as Gaelic acts as auditory proof of the persistence of Hebridean and Highland heritage, machair acts as a visual barometer of the survival of these same traditional Scottish cultures. As Fowlis says, "When I go to Uist I can see and hear songs and stories in the landscapes. I hear them in the lochs, on the machair, by the shore."³ Yet, if crofting were to disappear, so too could machair and the songs inspired by it. This landscape therefore exemplifies the ways in which ecosystems, in addition to cultural features like language, can act as indicators of the persistence of human communities whose influence they reflect. Machair, like many other habitats, also faces threats from forces much greater than those

¹ Julie Fowlis Official Website. "Julie." <http://www.juliefowlis.com/julie/> (Accessed September 25, 2017).

² Machair Records. "About Machair Records." <http://www.machairrecords.com/about/> (accessed September 25, 2017).

³ Brian Ferguson. "Gaelic singer to fight 'cultural erosion' with children's books." *The Guardian*. September 24, 2017.

that can be controlled by local residents: agricultural transformation, national and international market demands, and human-induced climate change. As the preservation of this habitat requires engaging with both local and global elements, the lessons learned from remote islands in the northwest of Scotland can be used to inform environmental study and policy surrounding practically any ecosystem.

Machair Significance

Machair is a rare habitat, currently listed within the EU Habitats and Species Directive, with the majority of this landscape found in the north and west of Scotland.⁴ It is particularly prevalent and well developed in the Outer Hebrides, but is also found within the Inner Hebrides, Orkney, the Shetland Isles, and the western coast of the mainland.⁵ The deep connection between this grassland and the cultures of these regions, particularly the Hebrides, is apparent when considering that machair is the only habitat universally known by a Gaelic term.⁶ Its long significance in these locations is also evident by place names, such as Machrihanish in Kintyre and Machair Bay in Islay, as well as archeology that suggests that machair acted as farming grounds for Neolithic settlements, including Skara Brae. This fertile grassland is characterized by its low-lying position and its sandy soil, which is often rich in lime and shell material,

⁴ Scotland remains in the EU at the time of writing. The 1999 UK Biodiversity Action Plan estimated that 30,000 ha of machair can be found in Scotland, cited in Martin Kent, Tom Dargie, and Catherine Reid. "The management and conservation of machair vegetation." *Botanical Journal of Scotland* 55, no. 1 (2003): 161-176; another estimate placed global machair area at 19,000 ha, cited in Paul Walton and Iain MacKenzie. "The conservation of Scottish Mahcair: a new approach addressing multiple threats simultaneously, in partnership with crofters." *The Glasgow Naturalist* 25 Supplement (2009): 25-28, <http://www.glasgownaturalhistory.org.uk/machair/conservation.pdf>.

⁵ Outer Hebrides machair spots: Barra, Harris, Lewis, Benbecula, and North and South Uist; Inner Hebrides machair spots: Rum, Tiree, Coll, Mull, Colonsay, Oronsay, Jura, and Islay; Scottish Natural Heritage. "Habitat Map of Scotland Annex I Habitat map – H21A0 Machair." [Snh.gov.uk](http://www.snh.gov.uk/docs/A2094556.pdf). <http://www.snh.gov.uk/docs/A2094556.pdf> (Accessed September 25, 2017).

⁶ S. Angus. "The conservation importance of machair systems of the Scottish islands, with particular reference to the Outer Hebrides," in *The Islands of Scotland: A Living Marine Heritage*, J.M. Baxter and M.B. Usher, eds. (Edinburgh: HMSO, 1994).

frequently making it alkaline. This soil is believed to have formed following the last Ice Age, emerging from glacial sediment mixed with marine animal shells, which was pushed onto the coast through wind and waves. These grassland plains often neighbor lochs, marshland, peatland, and “blackland,” a transitionary habitat that leads into moorland, which are all considered part the wider machair system.⁷

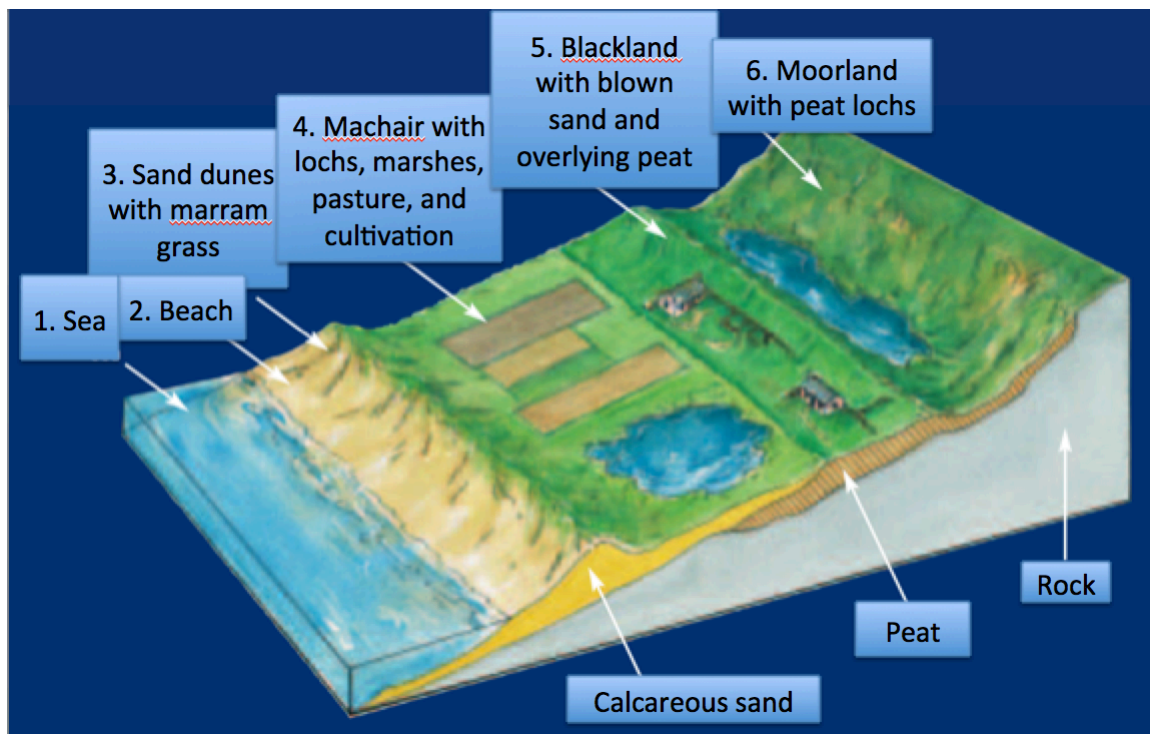


Figure 1. Illustration of machair system © Craig Ellery/SNH. Illustration included with permission by Scottish Natural Heritage. Label format adapted from original by author.⁸

This habitat is renowned for its unique composition of vegetation, most notably wildflowers, which in turn support a number of bird and invertebrate species. In fact, a single

⁷ W. Ritchie. “The Meaning and Definition of Machair.” *Transactions of the Botanical Society of Edinburgh* 42, no. 4 (1976): 431-440; J.P. Doody. *Sand dune conservation, management and restoration*. Dordrecht: Springer, 2013; John Love. *Machair: Scotland’s Living Landscapes*. Perth: Scottish Natural Heritage, 2003; Stewart Angus. *The Outer Hebrides: Moor and Machair* (Cambridge: The White Horse Press, 2001).

⁸ Love. *Machair*.

square meter of machair can support up to 45 different species.⁹ It is not surprising then that when described in the 1990s, the machair on the Monach Isles of the Outer Hebrides contained 180 flora species. While mainland dune systems surpass machair in diversity, boasting up to 500 species of flowering plants, machair is notable for the number of native species it supports, as opposed to introduced species. One of the most distinctive flowers in the machair is the orchid, some species of which are ecotypes, making them particular to that habitat, such as the Hebridean spotted orchid (*Dactylorhiza fuchsia hebridensis*). Machair is also significant for the mosaic pattern of different vegetation that creates numerous sub-communities, such as dry machair, damp machair, tall machair, and climbing machair, all of which are described in considerable detail by Stewart Angus in *The Outer Hebrides: Moor and Machair*.¹⁰

Upon first glance, especially when wildflowers are not in bloom, machair can appear similar to other coastal systems, like the “links” seen on the east coast. Machair can, however, be distinguished by the species composition present, the climatic conditions it faces on the west coast, and, most importantly, its historical development. It is therefore a “habitat created by sea, climate, and man.”¹¹ While humans and their technologies reach even the most remote

⁹ In terms of vegetation, machair cultivated for cereal crops includes species like scarlet pimpernel (*Anagallis arvensis*), red poppy (*Papaver rhoeas*), charlock mustard (*Sinapis arvensis*), forget-me-not (*Myosotis arvensis*), and field pansy (*Viola arvensis*). Machair land that has been left to lie fallow supports heartsease (*Viola tricolor*), creeping buttercup (*Ranunculus repens*), *Myosotis arvensis*, sea mouse-ear (*Cerastium diffusum*), and common stork's-bill (*Erodium cicutarium*) in the first year, and species like *Festuca rubra*, ragwort (*Senecio jacobaea*), *Bellis perennis*, common selfheal (*Prunella vulgaris*), *Trifolium repens*, and yarrow (*Achillea millefolium*) in the second year. In terms of birds, machair is associated with waders like the dunlin, ringed plover, and oystercatcher, and species associated with agriculture like the corncrake and corn bunting. A number of invertebrates species are significant within the machair, such as the great yellow bumblebee, northern Colletes bee, moss carder bumblebee, and belted beauty moth. See: Robin J. Pakeman, Sally Huband, Antoinette Kriel, and Rob Lewis. “Changes in the management of Scottish machair communities and associated habitats from the 1970s to the present.” *Scottish Geographical Journal* 127, no. 4 (2011): 267-287; Nicola A. Redpath-Downing, Dave Beaumont, Kirsty Park, and Dave Goulson. “Restoration and management of machair grassland for the conservation of bumblebees.” *J Insect Conserv* 17 (2013): 491-502; J.P. Doody. *Sand dune conservation, management and restoration*. John Love. *Machair: Scotland's Living Landscapes*.

¹⁰ Angus. *The Outer Hebrides*.

¹¹ Angus. “The conservation importance of machair systems of the Scottish islands, with particular reference to the Outer Hebrides,” 115.

ecosystems on earth, machair is a habitat that is particularly shaped by human forces, through agriculture. Key players in Scotland's modern rural history are crofters, farmers whose status as "crofters" are strictly defined by historical legislative categories, but who can be more simply characterized by their typical use of low-intensity agricultural techniques on small landholdings. Some engage in rotational crop production, growing unique varieties of rye, oats, barley, and potatoes on the machair then allowing the land to lay fallow to rebuild the nutrients in the soil. This kind of cultivation has, however, become limited outside of North and South Uist, in the Outer Hebrides. More commonly, coastal crofters rear livestock, ideally allowing low-intensity grazing on hill land during the summer and on the machair during the winter, though concern has been raised about increasing year-round grazing. Traditionally, these areas have rejected inorganic fertilizers, opting for seaweed or manure instead, yet recent decades have witnessed changes in fertilizer usage as well.

In sum, traditional agricultural practices have enabled a diverse mosaic landscape and the characteristic grass, crop, and flower mixture that makes this habitat distinctive. This diverse landscape then supports diverse fauna, including charismatic animals like corncrakes and oystercatchers.¹² The importance of crofting in continuing to shape, and in this case, support a vital landscape is a fact recognized not only by these rural communities, but also by researchers, government officials, and conservationists.¹³ These systems' bright colors and coastal locations also present a unique opportunity to engage the public in its preservation and highlight the importance of protecting flora, in addition to charismatic fauna. Outside of the symbolic heather and thistles, the nation's plants are not a major focus in representations of Scotland, particularly

¹² David I. McCracken. "Machair invertebrates: the importance of 'mosaicness.'" *The Glasgow Naturalist* 25 Supplement (2009): 29-30, <http://www.glasgownaturalhistory.org.uk/machair/invertebrates.pdf>.

¹³ For an ecological perspective see: Nia W. Owen, Martin Kent, and Pamela Dale. "Ecological effects of cultivation on the machair sand dune system of the Outer Hebrides, Scotland." *Journal of Coastal Conservation* 6 (2000): 155-170.

those for tourists. Machair, especially given its notable connection to a fascinating cultural heritage, offers the chance to correct this and emphasize the ways in which native vegetation enriches sites in agricultural, recreational, and ecological terms.¹⁴



Figure 2. Cows grazing in October, South Uist, © Chris and Christine Johnson



Figure 3. Fallow Uist machair field with wildflowers © Kieren Jones

¹⁴ Historically, wildflowers like cornflowers and corncockles, whose seeds would mix with those of crops, would be interspersed throughout farmers' fields. However, cleaner seed mixes and the use of herbicides have reduced the presence of these beautiful intruders. Further agricultural "improvement," common since the 18th century, has drained what was often considered wasteland, reducing the habitat of wet meadow and marshland species like globeflower, wood cranesbill, sea aster, and Scots primrose. Eelgrass, one of the only marine flowering plants, which creates underwater meadows, has likewise faced threats from pollution since the early 20th century. Scotland's flora, distinguished by the unique blend of arctic-alpine and marine species that survive here, has undoubtedly faced the same threats as more evidently significant species like commercial fish or seabirds. See: Michael Scott. "The Flowering of Scotland" in *The Nature of Scotland: Landscape, Wildlife and People*. Magnus Magnusson and Graham White, eds. (Edinburgh: Canongate Books, 1997).

Machair Species

Though there are many animals that are associated with machair landscapes, only two will be mentioned here in more detail, due to their high representation within ecological and conservation works and strong connection to agriculture: bumblebees and corncrakes. A substantial number of records indicate that bumblebee numbers throughout Europe have plummeted since the mid-20th century, largely due to habitat loss and a reduction in flower abundance and diversity.¹⁵ A review in 2007, for instance, surveyed sixty different taxa of bumblebees and cuckoo bees in eleven Western and Central European countries. It found that 80% of the taxa were threatened in at least one of the countries, 30% were threatened in all the countries, and four had suffered extinction throughout the entire area surveyed between 1951 and 2000. Large-scale farming appeared to be the largest factor influencing these declines.¹⁶ Unimproved grassland has traditionally been used for grazing and hay making, but more intensive methods have become more common, creating monocultures of fast-growing grass varieties that are cut early in the season for silage. Increasing farming intensity also brings machinery that can destroy bee nests, as well as hedgerows and peripheral vegetation. Artificial fertilizers have also reduced the use of red clover, a favorite of bees, which used to be important in traditional crop rotation cycles, given its ability to add nitrogen to the soil. Looking to Britain specifically, the extent of unimproved grassland dropped by 92% between 1932 and 1987 in England and Wales.¹⁷ Unsurprisingly then, of the twenty-five species of bumblebees native to

¹⁵ Dave Goulson. "Conservation of bumblebees." *The Glasgow Naturalists* 25 Supplement (2009): 31-34, <http://www.glasgownaturalhistory.org.uk/machair/bumblebees.pdf>.

¹⁶ Andrzej Kosior, Waldemar Celary, Pawel Olejniczak, and Jan Fijal. "The decline of the bumble bees and cuckoo bees (Hymenoptera: Apidae: Bombini) of Western and Central Europe." *Oryx* 41, no. 1 (2007): 79-88.

¹⁷ It's also worth noting that the use of chemicals and monocultures has made weeds and flowers increasingly rare on farmland, removing sources of food and shelter for the bees, as well as rodents, whose abandoned nests are used by bees. Goulson. "Conservation of bumblebees;" R. M. Fuller. "The changing extent and conservation interest

the United Kingdom, three have become extinct and eight have suffered serious declines.¹⁸

One of the rarest extant species is the great yellow bumblebee (*Bombus distinguendus*), whose pre-1950 distribution extended throughout the United Kingdom, but is now constrained to the Hebrides, Orkney, and occasional locations along the northern coast, where unimproved grasslands still offer forage and shelter. This represents 20% of the distribution present fifty years ago.¹⁹ Most of its historical distribution has witnessed intensive agriculture and grazing, reducing flower abundance.²⁰ Yet machair still remains rich in pollinator plants like red clover, due to the persistence of traditional farming techniques. It is not only flowers that are necessary for this species' survival, but also areas of unmanaged, grass tussocks to house the queen bee, which are uncommon on large-scale, intensively cultivated and grazed farms. Machair sites are therefore one of last refuges for this brightly colored species, which has been part of the UK Biodiversity Action Plan (BAP) since 1997 and has been a BAP Priority Species since 2007.²¹

of lowland grasslands in England and Wales: a review of grassland surveys 1930-84." *Biological Conservation* 40 (1987): 281-300.

¹⁸ The most recent species to disappear was *Bombus subterraneus*, once common throughout England, but which declined after WWII so that by the 1980s, they were largely confined to islands with nature reserves. The last individual was spotted in the Dungeness National Nature in 1988: Dave Goulson. *Bumblebees: their behaviour and ecology* (Oxford: Oxford University Press, 2003).

¹⁹ Bumblebee Conservation Trust. "Great Yellow Bumblebee." <https://bumblebeeconservation.org/about-bees/identification/very-rare/great-yellow-bumblebee/> (accessed September 27, 2017).

²⁰ Bumblebee Conservation Trust. "BBC Lifeline 2016 Appeal for the Bumblebee Conservation Trust." YouTube video, 8:53. Posted Aug. 23, 2016. <https://www.youtube.com/watch?v=grncbUWsdqY>.

²¹ N. Redpath, D. Beaumont, K. Park, and D. Goulson. "Machair and the great yellow bumblebee, *Bombus distinguendus* – a comparison of machair restoration techniques." *Glasgow Natural History Society* (2008). http://www.glasgownaturalhistory.org.uk/machair/great_yellow_bumblebee.pdf; Rebecca L. Evans and Simon G. Potts. "Iconic Bees: Scotland. Great Yellow Bumblebee." Friends of the Earth. 2013. https://www.foe.co.uk/sites/default/files/downloads/bees_scotland.pdf.



Figure 4. Great yellow bumblebee (*Bombus distinguendus*), © Chris and Christine Johnson.

As well as being managed for bumblebee presence, practices on the machair support an abundance of important bird species, a considerable advantage given the enormous level of support that bird-specific conservation receives in the UK.²² Migratory breeding waders like the dunlin (*Calidris alpina*) and ringed plover (*Charadrius hiaticula*), for instance, can reach densities of 100-200 pairs per hectare, much greater than that seen elsewhere in Europe.²³ A 1983 survey of machair on the Uists estimated a population of 17,000 breeding wader pairs, which included a quarter of the UK populations of ringed plover and dunlin. Other studies in the 1980s, estimated the Uist and Barra dunlin population as high as 36% of the UK population.²⁴ Two species that

²² These conservation efforts are detailed in chapter three.

²³ Doody. *Sand Dune Conservation, Management and Restoration*.

²⁴ David Beaumont and Stuart Housden. "The RSPB Scotland strategy for machair management with particular reference to birds and achievements of the great yellow bumblebee project." *The Glasgow Naturalist* 25, supplement (2009): 11-16. The timing of these studies are notable, as this level of population abundance was not truly appreciated until the 1970s and it was not until the 1980s, when machair was believed to be threatened by potential development (Western Isles Integrated Development Programme), that bird research accelerated. The 1990s were, however, a bad decade for these animals with 1995 counts showing breeding dunlins in South Uist down 65% from their 1980s numbers, ringed plover down 57%, redshank down 40%, snipe down 43%, and lapwing down 17%. Though land use did not change significantly in this time, suggesting other factors like gull and hedgehog predation were at least partially to blame, it is worth noting how anthropological factors like

are particularly dependent on traditional agricultural practices are the corn bunting (*Miliaria calandra*) and corncrake (*Crex crex*), as evidenced by their names. A brown bird dotted with black markings, which easily blends into the surrounding environment, the corncrake is perhaps better known (and found) by the male's distinctive call. It is a seasonal visitor to the UK, spending the winter in Africa and returning to Scotland for the breeding season.

Common throughout all of Britain and Ireland in the 19th century, corncrake numbers began to decline in southern and eastern England by the end of the century.²⁵ Newspaper articles in the 1920s placed the blame upon “the advance of scientific mechanical agriculture,” specifically the mower that “claimed its victims year by year with such regularity that few remain for it to slay.”²⁶ The contributors of these articles longed for the days of sickles and scythes that could not so easily destroy nests or injure the birds themselves.²⁷ Declines continued and since 1970 Corncrake habitat range in the UK has been reduced by 76%, explaining consequential decline in abundance from 3,250 calling males in the 1970s to 478 in 1993. Along with the destruction of nests by machinery, a large contributor to corncrake decline is modern changes in animal fodder production, which has switched from hay to silage within the last few decades. This allows farmers to cut fields earlier in the year, but reduces seed and nesting site availability for bird species. Corncrakes prefer habitats that include tall grass crops and vegetation throughout the summer, thus the low-intensity agriculture common on machair provides a significant refuge, though modern silage methods are creeping into these regions too. The marked conservation efforts by organizations like the RSPB and government programs have,

agricultural change could exacerbate declines from other stressors. See: Angus. *The Outer Hebrides*.

²⁵ Simon Holloway. *The historical atlas of breeding birds in Britain and Ireland: 1875-1900*, ed. David W. Gibbons (London: T. & A.D. Poyser, 1996); Angus. *The Outer Hebrides*.

²⁶ *The Western Daily Press (Yeovil, England)*. “Hither and thither.” April 18, 1925.

²⁷ *Derby Daily Telegraph*. “Nature notes and general topics.” August 25, 1925; *The North Devon Journal – Herald*. “Corn-crake’s decline.” July 20, 1950; *Essex Newsman-Herald*. “Blood is spilt beneath the peaceful corn.” August 1, 1950.

however, done much to try to reverse habitat loss, with the RSPB noting that conservation “works hand-in-glove with the crofting community.”²⁸



Figure 5. (Left) Corncrake (*Crex crex*) © Colin McPherson.

Figure 6. (Right) Ringed plovers (*Charadrius hiaticula*) © Dani Hallam.

Crofting History

The primary factor that shapes machair, outside of local climate and geology, is the practice of crofting, the history of which is vital to understanding the current state and protection of this landscape. This style of farming traces its roots to agricultural changes in the 18th and 19th centuries, which reduced communal farming and severely disadvantaged Highland and Island residents. Land included in the traditional runrig system, in which tenant farmers would cultivate joint holdings, was divided into small landholdings, called “crofts,” which were held by individual tenant farmers. These changes were part of what became known as the Highland Clearances, when farmers were forcibly removed from land and forced to emigrate to urban

²⁸ David Beaumont and Stuart Housden. “The RSPB Scotland strategy for machair management with particular reference to birds and achievements of the great yellow bumblebee project.” *The Glasgow Naturalist* 25, supplement (2009): 11-16; Doody. *Sand Dune Conservation, Management and Restoration*; Pakeman et. al. *Scottish Geographical Journal*, 2011; RSPB. “Corncrake Population Trends.” https://www.rspb.org.uk/birds-and-wildlife/bird-and-wildlife-guides/bird-a-z/c/corncrake/population_trends.aspx (accessed September 29, 2017); “Corncrake populations reach highest levels since counts began.” *Am Pàipear.org.uk*. October 2, 2014. <http://www.ampaipear.org.uk/category/crofting/page/3/>.

areas or overseas, a process outlined in greater detail later in the chapter. Those who could continue farming on newly formed crofts were often pushed to peripheral, coastal locations on unproductive soil. This land enabled some subsistence agriculture, but the scale was small enough and the climate harsh enough to demand additional forms of labor, like fishing, kelp gathering, or whisky production, a legacy that lasts to this day, given that only about 30% of the average crofter's income originates from the croft itself.²⁹

Today, it is largely location and legislation that differentiates a “croft” from a small farm, with crofts ranging in size from one acre to over a hundred, though the average falls around twelve. Crofts have been regulated for years by the Crofting Acts and are found in the regions formerly designated as “crofting counties” – Argyll, Invernesshire, Ross and Cromarty, Sutherland, Caithness, Orkney, and Shetland. About 11% of the population of remote rural areas are considered crofters.³⁰ There are two primary bodies associated with crofting. The first is the Crofting Commission, formerly the Crofters Commission, which is an executive non-departmental public body that operates independently of the government, “but for which Scottish Ministers are ultimately responsible.”³¹ The Commission's purpose is to regulate crofting, including maintaining the Register of Crofts and reviewing applications for processes like decrofting and subletting. The other primary body is the Scottish Crofting Federation, a non-governmental charity. The SCF advertises itself as “the largest association of small scale food producers in the UK,” with inexpensive membership providing nearly two thousand crofters

²⁹ Tom Edwards. Scottish Parliament Information Center (SPICe) Briefing: Crofting Reform (Scotland) Bill. The Scottish Parliament, January 8, 2010; Committee of Inquiry on Crofting. *Crofting Inquiry Final Report*. Edinburgh: RR Donnelley, 2008.

³⁰ Remote rural areas are defined as settlements composed of fewer than 3,000 people, located more than a thirty-minute drive from a settlement of at least 10,000 people: Tom Edwards. Scottish Parliament Information Center (SPICe) Briefing: Crofting Reform (Scotland) Bill. The Scottish Parliament, January 8, 2010; Committee of Inquiry on Crofting. *Crofting Inquiry Final Report*. Edinburgh: RR Donnelley, 2008.

³¹ “About us.” Crofting Commission, accessed December 12, 2017, <http://www.crofting.scotland.gov.uk/about-us>.

access to a number of services like legal advice, training, advocacy, and regular publications.³² In general, the SCF has a record of lobbying for the rights of small-scale crofters. For instance, they have objected to the uneven agricultural subsidies that work against disadvantaged agricultural areas, where most crofts are located, and have lobbied for changes to the Scottish Upland Sheep Support Scheme, which favors large-scale farms.³³

While crofting as a system emerged during the Clearances, its current form can be traced back to the Crofters Holdings (Scotland) Act of 1886, which offered farmers protections that had not been present during the Highland Clearances. This act was preceded by a number of pivotal events. In 1881 and 1882, crofters experienced bad harvests and a storm that damaged many fishing boats, stressors that contributed to violent confrontations between crofters and police on the Isle of Skye. The grievances of Scottish crofters also became more visible following the Irish Land Reform Act of 1881, which added to the rights of Irish tenant farmers. As a result of these issues and tensions, the Highland Land Law Reform Association was formed in 1883, the same year the government established the Commission of Inquiry into the Conditions of the Crofters and Cottars in the Highlands and Islands, better known as the Napier Commission.

³² The Crofting Commission is the only public body in Scotland where the majority of its members are elected by the people that the body regulates, with six Commissioners elected by crofters and three appointed by Scottish Ministers. In the most recent Crofting Commission elections in 2017, the SCF encouraged more female and young crofters to run for office, though only one woman was elected in the end. The Crofting Commissioners work part-time, four and a half days per month, for a salary of £8,796.60 per year. SCF representatives are volunteers. The eight Board Members in 2017 included two women (the Vice Chair and a Director), as well as a young crofter (a Director). The membership rate for individuals in 2017 was £63 per year, see: "Welcome to the Scottish Crofting Federation." Scottish Crofting Federation, accessed December 11, 2017, <http://www.crofting.org/>; "News Release: Crofting Federation welcomes review of Commission." Scottish Crofting Federation, November 15, 2016, <http://www.crofting.org/uploads/news/reviewofcommission.pdf>; "News Release: Crofting Federation calls on women and youth to stand for election." Scottish Crofting Federation, January 17, 2017, <http://crofting.org/uploads/news/youth.pdf>; "Meet the Commissioners." Crofting Commission, accessed December 12, 2017, <http://www.crofting.scotland.gov.uk/meet-the-commissioners>; "SCF Board Members." Scottish Crofting Federation, accessed December 12, 2017, http://www.crofting.org/index.php/contact_directors.

³³ "Memorandum by the Scottish Crofting Foundation." UK Parliament. June 11, 2007. <https://publications.parliament.uk/pa/ld200708/ldselect/lddeucom/54/54we22.htm>; Nancy Nicolson. "Large producers 'misuse' sheep support scheme." *The Press and Journal*. August 2, 2017.

Their investigations led to the Crofter's Act 1886, which provided security of tenure, fair rent, and compensation for improvements made to crofts.³⁴ The same year witnessed the establishment of the Crofters Commission, which was dismantled in 1911, but reestablished in 1955.³⁵

The year 1886 therefore marks the beginning of a change in government policy, in which the focus turned to attempting economic development, with local involvement, a trend that lasts to this day. It is worth noting, for example, that the 1886 act ensured security of tenure to *all* crofters, despite the Napier Commission recommending that only crofters paying more than £10 in annual rent should be given tenure, in order to discourage uneconomic crofts.³⁶ In addition, not only had the government banned the arbitrary evictions of tenant farmers through the 1886 act, but it also now began to purchase land to distribute to crofters. In 1906, landless men from Barra claimed territory on the nearby island of Vatersay, in the Outer Hebrides. This island, however, was the property of Lady Gordon Cathcart, who reportedly had only visited the island once in her life. Cathcart took the men to court, who were sentenced to two months in prison, yet the judge also declared that she had neglected her duties as a landowner. In 1909, the government, through the Congested Districts Board, bought Vatersay and divided the land into 58 crofts, which was then inhabited by people from neighboring, crowded islands like Mingulay.³⁷ Some were outraged by such a policy, as evidenced by a piece in the *Aberdeen Daily Journal*:

³⁴ R. A. Dodgshon. *No Stone Unturned: A History of Farming, Landscape and Environment in the Scottish Highlands and Islands* (Edinburgh: Edinburgh University Press, 2015).

³⁵ Pakeman et. al. *Scottish Geographical Journal*, 2011; Susan Parman. *Scottish crofters: a historical ethnography of a Celtic village*. Belmont: Thomson/Wadsworth, 2005.

³⁶ J. B. Caird. "The making of the Scottish rural landscape." *The Scottish Geographical Magazine* 80, no. 2 (1964): 72-80.

³⁷ "The story of the Vatersay raiders." *BBC News*. June 7, 2007, http://news.bbc.co.uk/2/hi/uk_news/scotland/highlands_and_islands/6653709.stm.

It is high time the country was crying out against this squandering of the public money on the crofters of the Outer Hebrides. They are being unduly nursed, and are not improving under the grandmotherly legislation of recent years. They are becoming more proud, lazy, and lawless. Encouraged by their success in securing Vatersay, they will no doubt be raiding Eoligarry sheep farm, in the north end of Barra, while their neighbours in South Uist will likely be soon seizing parts of the large farms of Milton or Ormaclete. All this seizing of land is for political purposes; and the crofters are put up to it.

The author proclaimed that crofters were not as enterprising as those on the East Coast and that Hebridean men should emigrate or enlist, or otherwise “be allowed to starve,” though it was thought that even men who enlisted only did so to claim their free boots and clothing and six-week “holiday” to the mainland.³⁸ Any other far-fetched criticisms that may have existed did not prevent the passing of the Land Settlement (Scotland) Bill of 1919, which gave the Board of Agriculture the ability to purchase land to be distributed as crofts. On Skye, for instance, 51,000 acres were bought to establish over two hundred new crofts.³⁹ Twenty years following the Vatersay acquisition, the *Aberdeen Daily Journal* published another piece voicing “grave doubts” over the purchase of land in Harris that was thought to be “encouraging people to live under conditions of poverty.”⁴⁰

Even after massive modernization of agricultural techniques following WWII, a 1954 report insisted that it was necessary to preserve crofting communities as they “embody a free and independent way of life which in a civilisation predominantly urban and industrial in character is worth preserving for its own intrinsic quality.”⁴¹ Similar sentiments were expressed in the *Scottish Journal of Political Economy* the same year, as it stated, “the national conscience is stirred by the knowledge that the crofting way of life represents one last bulwark of the traditional freedom and independence of a pre-industrial civilisation, and supports a virile,

³⁸ *Aberdeen Daily Journal*. “Vatersay Island.” March 9, 1909.

³⁹ Dodgshon. *No Stone Unturned*.

⁴⁰ *Aberdeen Press and Journal*. “Government blunder in land deal.” September 28, 1929.

⁴¹ Parman. *Scottish crofters*, 45.

intelligent peasant stock to which the nation has owed a great debt in war and peace in the last two hundred years.”⁴² Though the rhetoric has changed much from this admiration of the “intelligent peasant stock,” crofting remains a highly valued feature of Scotland’s agriculture, both within and outwith rural communities, a fact that provides direct benefits to dependent machair species.

Coastal Concerns

The field of environmental history has long recognized that no ecosystem, no matter how remote, is free from human influence.⁴³ With the global nature of threats like climate change, pollution, invasive species, and habitat destruction, much of this impact can act to reduce biodiversity. The 1992 UN Environment Programme’s Convention on Biological Diversity (CBD) summed up these dangers stating:

...from the dawn of agriculture through the Industrial Revolution we have reshaped our landscapes on an ever-larger and lasting scale...By consuming ever more of nature’s resources, we have gained more abundant food and better shelter, sanitation, and health care, but these gains are often accompanied by increasing environmental degradation that may be followed by declines in local economies and the societies they supported.⁴⁴

Within this alarming context, the history of machair represents a rare opportunity to understand the ways in which humans and non-human species can coexist in mutualistic relationships. Yet, social, economic, and environmental forces have combined, in the past and present, to endanger this unique habitat.

First, it is worth noting that although there are novel threats facing machair, largely the product of changes within the last century, concerns over coastal vegetation and erosion are not new, particularly given the low-lying and exposed nature of these grasslands. For instance,

⁴² T. A. F. Noble. “The future of crofting.” *Scottish Journal of Political Economy*, June 1954.

⁴³ William Cronon. “The trouble with wilderness: or, getting back to the wrong nature.” *Environmental History* 1, no. 1 (1996): 7-28; Oliver Rackham. *The History of the Countryside*. London: J. M. Dent & Sons Ltd., 1986.

⁴⁴ Alasdair Reid. *Biodiversity: SPICE briefing*. Edinburgh: The Scottish Parliament, 2007.

medieval accounts reveal the existence of a township named Hussaboste, which disappeared from records after the 15th century and now likely lies underwater, off the coast of Baleshare in the Outer Hebrides.⁴⁵ In 1695, An Act for the Preservation of Meadows, Lands, and Pasturages Lying Adjacent to Sand Hills was enacted, the regulations of which were strengthened in 1742 when it was declared that “if any bent shall be pulled or cut from any sand hills in that part of Great Britain called Scotland either by the Lord or owner thereof or by any other person or persons whatsoever such person or persons being convicted thereof shall be subject and liable to the like penalties and forfeitures” of the said act.⁴⁶ Even being found in possession of this grass within eight miles of a sand dune was considered an offense. These laws appear to have been passed for good reason, considering a 1764 account that described the west coast of South Uist as a “dead plain...the shore is fenced with vast banks of blowing Sand, with which the whole Country is flooded in Time of Storms.”⁴⁷ As will soon be detailed, much of the deterioration witnessed in previous centuries, which was almost certainly worse than that seen today, was the result of the heavy exploitation of kelp, a species that helps to protect shorelines from erosion.

Later, in the case of *Duthie of Cairnbulg v. Deer District Committee* in 1906 in Aberdeenshire, the sheriff banned road trustees from extracting rock and material from the foreshore, as this lessened the village’s protection from the sea. Many Harbor Acts contained similar interdictions against removing material near harbors.⁴⁸ In 1949, the Coastal Protection Act was passed. This gave local authorities, such as county councils, power to protect any land against erosion and encroachment of the sea, not just publically owned land. Under this law, the

⁴⁵ Stewart Angus and Mary M. Elliott. “Erosion in Scottish machair with particular reference to the Outer Hebrides” in *Coastal Dunes: Geomorphology, Ecology and Management for Conservation*, eds. R. W. G. Carter, T. G. F. Curtis, and M. J. Sheehy-Skeffington (Rotterdam: A. A. Balkema Publishers, 1992).

⁴⁶ Royal Commission on Coast Erosion. A Statement of the Laws Relating to the Foreshore of Scotland. 1909. CR7/2471, Royal Commission on Coastal Erosion 1909, National Records, Edinburgh, Scotland.

⁴⁷ Angus and Elliott. “Erosion in Scottish machair with particular reference to the Outer Hebrides,” 99.

⁴⁸ Royal Commission on Coast Erosion. A Statement of the Laws Relating to the Foreshore of Scotland. 1909.

Scottish Executive may provide grant aid for up to 80% of the project expenses. These grants cannot, however, be awarded to landowners, who are ultimately responsible for coastal defense on private land, as local authorities are allowed, but not obliged to protect such eroding coastlines. Today, a number of bodies must also be consulted regarding project plans, including the Scottish Environment Protection Agency (SEPA) and the Scottish Natural Heritage (SNH), a statutory body responsible for protecting Scotland's natural features.⁴⁹

A search of historic Parliamentary debates, archived online, reveals little discussion of machair specifically before the late 20th century.⁵⁰ When it does emerge, the focus is generally limited to the agricultural and social importance of this land. For instance, a debate emerged in the House of Lords in 1955 regarding the proposed construction of a guided missile range in the Hebrides, which was controversial given that it would lie atop land that supported productive machair and up to seventy crofts. Admittedly, the Earl of Haddington did make an appeal for the local wildlife noting, "Parliament has just passed an Act for the better protection of wild birds, an Act which has been widely acclaimed all over the world."⁵¹ Lord Windlesham's rebuttal insisted that national defense was more important than the birds or archeology threatened by the project. In the end, the range of activities planned for the space was reduced and in 1957 it was announced that less land than anticipated would be needed.⁵² Judging by the points debated in 1955, this change was likely due to logistical reasons or to the social and agricultural importance placed on crofters, not necessarily the machair itself. The missile range was not, however, the

⁴⁹ A note on the Coast Protection Act 1949. DD13/3039, Coastal Protection 1967-1969, National Records, Edinburgh, Scotland; "Coast protection legislation in Scotland." Scottish Natural Heritage, accessed February 16, 2018. <http://www.snh.org.uk/publications/on-line/heritagemanagement/erosion/3.1.shtml>.

⁵⁰ These records are available in the database Hansard 1803-2005.

⁵¹ "Hebrides Guided Missile Range." HL Deb 27 October 1955, vol 194, cols 75-108, http://hansard.millbanksystems.com/lords/1955/oct/27/hebrides-guided-missile-range#S5LV0194P0_19551027_HOL_47

⁵² "Hebridean Guided Missil Range." HL Deb 04 December 1957, vol. 206, cols. 751-3 <http://hansard.millbanksystems.com/lords/1957/dec/04/hebridean-guided-missile-range>

only facility for which machair was deemed the perfect spot. The Lionel Machair on the Isle of Lewis, for instance, was used similarly as an airplane landing ground earlier, in 1935.⁵³

Beyond logistical advantages for military and aeronautical technology, the aesthetics of machair also made it vulnerable to recreational development. In the 1890s, at least two golf courses were constructed upon Hebridean machair. In 1891, Willie Campbell, a famous golfer himself, traveled to Islay to design the Machrie Course at Port Ellen. The course, which sat upon the machair, extended over 6,000 yards, one of the longest at the time.⁵⁴ The same year, another golfer, Tom Morris, visited South Uist with the hopes of constructing a course upon the machair where “the space is unlimited, and eminently suited for this popular game.”⁵⁵ By 1896, the new clubhouse for the South Uist Golf Club had opened upon the Askernish Machair.⁵⁶ Development on this grassland has been limited overall, notable exceptions being Benbecula Airport, Stornoway Airport, and military buildings on Benbecula and South Uist.⁵⁷ Tourism does, however, continue to pose a threat to machair, particularly activities like caravanning, an issue that has been covered in detail by others.⁵⁸

It was arguably in the 1970s that concern over erosion and degradation of machair notably accelerated, in line with broader international movements focused on environmental issues. In 1973, the Machair Study Group was created, meeting annually in the Hebrides and publishing journals on the state of machair. These journals pointed to some of the same stressors

⁵³ *The Evening Telegraph and Post (Dundee, Scotland)*. “Landing-grounds at Stornoway.” April 27, 1935.

⁵⁴ Brian J DeLacey and John Pearson. “Willie Campbell.” *Through the Green* (ca. 2004-2005): 9-15, <http://www.nga-earlygolf.nl/golfarchief/files/original/eee900792af0c6074e67020a0a4975e3.pdf>.

⁵⁵ *The Evening Telegraph*. “Golf in South Uist.” July 29, 1891.

⁵⁶ *Glasgow Herald*. “Golf.” August 12, 1896.

⁵⁷ Stewart. *The Outer Hebrides*.

⁵⁸ *Coastal Dune Management: Shared Experience of European Conservation Practice*, eds. J. A Houston, S. E. Edmondson, and P. J. Rooney (Liverpool: Liverpool University Press, 2001).

as today: climatic changes, mismanaged recreation, and overgrazing by sheep and rabbits.⁵⁹ Unsurprisingly, machair also received attention in bird studies journals, which noted the problems of shorter rotation cycles, pesticides, drainage, and general agricultural intensification.⁶⁰ The 1980s brought further worries that threatened to hatch intense conflict between agriculturalists and conservationists. In 1982, Parliament debated the Western Isles Integrated Development Programme (IDP), jointly funded by the European Economic Community and the British Government to support economic development in marginal areas through support for infrastructure, tourism, crafts, agriculture, forestry, and fisheries. The need for the program was evident when considering that up to 39.4% of men in the Western Isles were technically unemployed at the time.⁶¹ Of the £56.6 million to be allotted over five years, £20 million was available for agriculture, £3.4 million of which was to be spent on “land improvements” like drainage and reseeded. Lord Melchett brought the debate to the table, emphasizing that he supported the IDP, but was concerned about a small portion of the project. 10,000 ha of common grazings, 13,000 ha of inbye land, and 1,000 ha of machair had been slated for improvement on North and South Uist and Benbecula. His greatest concern was the wet machair that was to be drained and reseeded, with little agricultural benefit compared to the cost to “probably the most important area for birds and wild plants in the whole of the United Kingdom” for which they had “an international responsibility for safeguarding.”⁶² Lord Melchett also used a common tactic of revealing Scottish disadvantage compared to their southern

⁵⁹ W. Ritchie and R. J. Ardern. “A bibliography of machair,” in *Sand Dune Machair 3: Report on meeting in the Outer Hebrides 14-16th July 1978*, ed. D. S. Ranwell (Norwich: Institute of Terrestrial Ecology, 1980); W. T. Band. “Machairs for recreation,” in *Sand Dune Machair 3*; D.S. Ranwell, ed. *Sand Dune Machair: Report of a Seminar at Coastal Ecology Research Station Norwich* (Norwich: Institute of Terrestrial Ecology, 1974).

⁶⁰ J. R. Wilson. “Agricultural influences on waders nesting on the South Uist machair.” *Bird Study* 25, no. 4 (1978): 198-206.

⁶¹ J. Graema Robertson. *Machair Under Threat* (Portree: Habitat Scotland, 1982).

⁶² “Western Isles Integrated Development Programme (Scotland) Regulations 1982.” HL Deb 20 October 1982, vol 435, cols 125-68, <http://hansard.millbanksystems.com/lords/1982/oct/20/western-isles-integrated-development>

neighbors, when he noted that more breeding birds could be found in 100 acres of the best land in the Hebrides than in the whole of the Somerset Levels, which had nonetheless received much more impressive conservation attention.

Those in favor of amending the IDP made a number of arguments that highlighted the increasing awareness of machair's ecological importance and the growing holistic trend in conservation of protecting habitats in their entirety, which then benefits key species as well. For instance, an emphasis of the EU Birds Directive, adopted three years earlier in 1979, is protecting Europe's birds from habitat loss.⁶³ A decade after the IDP debate, the EU would likewise create the Habitats Directive of 1992, to promote "biodiversity, taking account of economic, social, cultural and regional requirements."⁶⁴ Lord Melchett played upon such agreements, arguing that it would be a small compromise for the IDP to allow at least the wet machair to remain intact for the sake of adhering to international legal obligations, even if the chosen machair lay outside of more protected areas like Sites of Special Scientific Interest (SSSIs).⁶⁵ Outside of the walls of Westminster, there were also accusations that the Nature Conservancy Council, a predecessor body to the SNH that managed nature reserves and conservation issues at the time, were being pressured to refrain from objecting to IDP plans.⁶⁶

These habitats were also vital to tourism, according to Lord Melchett, who noted an American tour company whose trips spent time in the Western Isles in addition to famous manmade monuments. "I suggest that if Hadrian's Wall, York Minster or Windsor Castle were

⁶³ "The Birds Directive." European Commission, last modified June 10, 2016, accessed February 22, 2018, http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm.

⁶⁴ "The Habitats Directive." European Commission, last modified June 10, 2016, http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm.

⁶⁵ An SSSI is a British designation for an area that houses features of interest in terms of flora, fauna, geology, or geomorphology. It is an offense to damage the natural features protected by such designation and any future land improvement projects by crofters or landowners must be approved in advance. The body in charge of regulating these improvements at this time was the Nature Conservancy Council.

⁶⁶ HL Deb 20 October 1982, vol 435, cols 125-68; Robertson. *Machair Under Threat*.

threatened by the integrated development programme, people interested in tourist development in this country would have something to say about it,” he offered, once again playing upon the greater attention perceived to be paid to English sites.⁶⁷ In addition, he suggested that the “birds versus people argument” was “a conflict entirely and exclusively of the Government’s making,” suggesting that conservationists made substantial efforts to understand local social conditions, evidenced by the fact that the RSPB had been making annual trips to the Hebrides since 1950, more than the Department of Agriculture and Fisheries.⁶⁸ Lord Craighton offered further support to Lord Melchett’s tourism argument, noting that the IDP would use taxpayer money to endanger a wildlife sanctuary that attracted visitors. The Earl of Onslow agreed and suggested that crofters could be better helped by using the money to subsidize ferry services instead of destroying “not only the heritage of the Western Isles but the heritage of us all.”⁶⁹ Earl Ferrers, Minister of State for the Ministry of Agriculture, Fisheries and Food would reiterate these views the following year when he pointed out that tourism on farms was worth £100 million in the UK, with as many as 16% of farmers participating.⁷⁰ Today, a number of ecotourist destinations succeed in the area, the RSPB Balranald Reserve, made possible through a partnership with crofters, being one of the biggest attractions in the Western Isles.⁷¹

Of course, not all members of the IDP debate admitted the importance of wet machair. The Baroness Elliot of Harwood, for example, asked to “remind your Lordships that if you let land just go back to bog, if you let land rot, what will happen is that it will be overrun by a great

⁶⁷ HL Deb 20 October 1982, vol 435, cols 125-68.

⁶⁸ HL Deb 20 October 1982, vol 435, cols 125-68.

⁶⁹ HL Deb 20 October 1982, vol 435, cols 125-68.

⁷⁰ “Farming.” HL Deb 02 February 1983, vol. 438, cols. 810-80

http://hansard.millbanksystems.com/lords/1983/feb/02/farming#S5LV0438P0_19830202_HOL_146

⁷¹ David Beaumont and Stuart Housden. “The RSPB Scotland strategy for machair management with particular reference to birds and achievements of the great yellow bumblebee project.” *The Glasgow Naturalist* 25, Supplement (2009): 11-16, http://www.glasgownaturalhistory.org.uk/machair/rspb_scotland.pdf.

many vermin.”⁷² Although an imaginative piece of ecological fiction, the Baroness’s argument aligns with centuries of drainage and reclamation projects in Europe that viewed wetlands as places of disease, filth, and immorality.⁷³ With regards to fears about machair destruction through drainage and reseedling, Lord Taylor of Gryfe suggested that “the noble Lord [Melchett] is dreaming dreams which have no reality, and he is creating a monster which has no substance.”⁷⁴ Lord Walston went so far as to suggest that asking crofters to consider birds like corncrakes in their management practices was akin to Seigneurs who forbade peasants from cutting hay until partridges had flown from the fields, an apparent cause of the French Revolution. The criticism of conservationists extended into the press. Such opinions were labeled “alarmist” and “hysterical pronouncements” in the *West Highland Free Press* and articles in *The Scotsman* spoke of the “crass insensitivity of the environmentalist” and the “mindless criticism of economic prospects for the Highlands and Islands by the ecological lobby.”⁷⁵ This opposition was, of course, concerned about the extreme levels of unemployment and depopulation the Hebrides were experiencing. However, their rebuttals did little to recognize that it was not a rejection of the IDP being suggested, but an amendment, representing 4% of the area marked for improvements, which themselves were only 6% of the total budget.

Despite the conflicts that would arise, by the end of the 20th century, the ecological importance of machair was firmly recognized along with its social significance and in 2000 the Scottish Natural Heritage began Site Condition Monitoring (SCM) for protected areas. At this time, dozens of machair sites had received some form of protection: 37 sites in Special Sites of Scientific Interest (SSSI), 8 sites in Special Areas of Conservation (SAC), and 2 sites within

⁷² HL Deb 20 October 1982, vol 435, cols 125-68.

⁷³ David Blackbourn. *The conquest of nature: water, landscape, and the making of modern Germany*. New York: Norton, 2006.

⁷⁴ HL Deb 20 October 1982, vol 435, cols 125-68.

⁷⁵ Robertson. *Machair Under Threat*, 1.

Ramsar sites.⁷⁶ Of the forty-four sites surveyed between 2000 and 2005, nearly half were considered in “unfavourable” condition.⁷⁷ It is therefore worth considering the factors that may have contributed to this “unfavourable” status, as well as the actions being promoted to amend this.

Machair Cultivation Changes

The most direct potential threat to machair survival comes in the form of agricultural transformations. The characteristic species composition of these coastal grasslands are directly created and supported by crofting practices in a number of ways. In places like the Uists, where cropping of the machair by crofters still occurs, local strains of rye, small oat, and bere, a type of barley, are all grown, mainly for animal fodder. These varieties are known as landraces and are part of the Scottish Landrace Protection Scheme, established in 2006. Crofters donate locally produced seeds, where they are stored and returned in the event of a bad year, as well as shared among other crofters. Small oats are favored because of the volume produced and their tolerance for nutrient deficiency, a common issue on machair soil, though most seeds exist as mixtures of these cereals.⁷⁸ These mixtures provide crofters with security in an unpredictable environment

⁷⁶ An SAC is a European designation, protecting an area listed with the EU Habitats Directive. A Ramsar site is a wetland area designated under the Convention on Wetlands of International Importance: SNH. “Sites of Special Scientific Interest,” accessed February 15, 2018, <https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/national-designations/sites-special-scientific-interest>; SNH. “Special Areas of Conservation,” accessed February 15, 2018, <https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/international-designations/natura-sites/special-areas-conservation-sacs>; SNH. “Ramsar Sites,” accessed February 15, 2018, <https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/international-designations/ramsar-sites>.

⁷⁷ Stewart Angus. “Dé tha cearr air a’mhachaire? Biodiversity issues for Scottish machair: an initial appraisal.” *The Glasgow Naturalist* 25 Supplement (2009): 53-62, http://www.glasgownaturalhistory.org.uk/machair/de_tha_cearr.pdf.

⁷⁸ Maria Scholten, Bill Spoor, and Niall Green. “Machair corn: management and conservation of a historical machair component.” *The Glasgow Naturalist* 25 Supplement (2009): 63-71, http://www.glasgownaturalhistory.org.uk/machair/machair_corn.pdf; Niall Green, George Campbell, Rachel Tulloch, and Maria Scholten. “Scottish Landrace Protection Scheme” in *European Landraces: On-Farm*

with small oats offering high yields, rye tolerating drier conditions, and bere favoring wetter weather.⁷⁹ There has also been a recent effort to include flowering species like clover in these mixes, which could benefit species like the great yellow bumblebee.⁸⁰

From an environmental perspective, these varieties are important because they are capable of surviving with wildflowers like corn marigold, field pansy, and charlock mustard. Rotational cropping, in which the ground is left fallow between cultivation years, then allows for further growth of wildflowers like poppies, creeping buttercup, and clover. However, this vital crop production has disappeared in many crofting areas. For instance, the area of land cropped on holdings of less than 30 hectares fell by 49% between 1982 and 2007, with the greatest decreases seen in the area of oat and potato production. Unsurprisingly, then, between 1982 and 2010, cereals have virtually stopped being grown on the islands of Barra, Lewis, Harris, and Tiree and have even declined in strongholds for traditional cultivation, like the Uists. Even when cereal crops are produced, changes in harvest methods can threaten machair fauna. For decades, crofters have been switching from haymaking, an inherently risky process given the potential of rot in the wet climate of Scotland, to producing green silage for animal feed. With the help of modern machinery, crops can also be harvested earlier in the season. These changes, along with reductions in peripheral patches of tall grass and vegetation, reduce food and shelter for machair birds and the ability of wildflowers coexisting with crops to set their seeds. This transformation may explain the 62% reduction seen among breeding corn buntings in agricultural areas of the

Conservation, Management and Use, eds. Merja Veteläinen, V. Negri, and Nigel Maxted (Rome: Biodiversity International, 2009).

⁷⁹ J. W. Grant. "Cereals and grass production in Lewis and the Uists." *Proceedings of the Royal Society of Edinburgh* 77B (1979): 527-533.

⁸⁰ Beaumont and Housden. . "The RSPB Scotland strategy for machair management with particular reference to birds and achievements of the great yellow bumblebee project."

Western Isles between 1995 and 2005.⁸¹ Intensive agricultural practices that produce “neater” but less habitable fields for wild plants and animals are recognized as a threat to biodiversity by organizations like the IUCN and could be changing the landscapes that have been developing on these coastlines for centuries, and even millennia.⁸²

Historically, coastal crofting has seized upon the natural advantages of the marine environment to enhance crop production. “The use made by crofters of the gifts of the sea merits a book in itself,” according to the late crofter and poet Alasdair Maclean.⁸³ “Crofting in its heyday, was a finely evolved system for extracting the maximum amount of nourishment from the minimum amount of ingredients.”⁸⁴ Thus, seaweed has traditionally been used as a fertilizer for machair, even following the advent of modern synthetic chemicals. These plants not only enrich the soil’s nutrient content, but they also stabilize it and add moisture to reduce wind erosion. Kelp forests near shore additionally reduce the force of waves and stray seaweed that washes ashore acts as further protection.⁸⁵ History provides evidence of the importance of these marine plants. In the 18th and 19th centuries, kelp was burned to use for glass, soap, gunpowder, and bleaching agents. The kelp industry was so lucrative that landlords could make twice as much through kelp than through rent and crofters could easily spend more time harvesting seaweed than working on their fields. Yet, reduction in kelp meant increased vulnerability for machair and an 1811 report noted that certain locations lost a quarter mile in width from sand

⁸¹ John Love. *Machair: Scotland’s Living Landscapes*. Perth: Scottish Natural Heritage, 2003; Doody. *Sand Dune Conservation, Management and Restoration*; Pakeman et. al. *Scottish Geographical Journal*, 2011; Alasdair Maclean. *Night Falls on Ardnamurchan: The Twilight of a Crofting Family* (London: Victor Gollancz Ltd., 1984).

⁸² For an example, see the impact of intensive agricultural of wild crop varieties: “Unsustainable food systems threaten wild crop and dolphin species – IUCN Red List.” IUCN, last modified December, 5, 2017, <https://www.iucn.org/news/species/201712/unsustainable-food-systems-threaten-wild-crop-and-dolphin-species-%E2%80%93-iucn-red-list>.

⁸³ Maclean. *Night Falls on Ardnamurchan*, 95.

⁸⁴ Maclean. *Night Falls on Ardnamurchan*, 61.

⁸⁵ Love. *Machair: Scotland’s Living Landscapes*; Doody. *Sand Dune Conservation, Management and Restoration*.

drift and the force of the ocean.⁸⁶ There are now fears that the use of seaweed fertilizer is declining and the use of inorganic fertilizers rising. These chemicals are known to decrease diversity by supporting the growth of fewer, more competitive species.⁸⁷

The growth of artificial fertilizer is truly a history in itself, explored by scholars like Vaclav Smil in *Enriching the Earth* and Hugh Gorman in *The Story of N*.⁸⁸ The chemicals that have become such a headache to conservationists trace their history to the work of Fritz Haber and Carl Bosch. By the mid-19th century scientists recognized that the availability of nitrogen was one of the primary factors limiting agricultural productivity, but nitrogen sources were limited to manure, guano, sodium nitrate deposits, the by-products of coal, or natural fixation through legumes. It was not until the Haber-Bosch industrial process of nitrogen fixation that nitrogen availability exploded, with the first ammonia factory emerging in 1913. This development made techniques like rotating crops and organic fertilizers like guano appear obsolete. The World Wars furthered the need for nitrogen, not only to help feed warring populations, but also to produce explosives. In 1937-38, annual expenditure on lime and artificial fertilizer in the UK was £8 million, whereas in 1950-51 it was £51 million. This increase was no doubt furthered by the subsidies provided for fertilizers in the Agricultural Act of 1947. Now, most modern agricultural production is entirely dependent on these synthetic

⁸⁶ Love. *Machair*.

⁸⁷ Sebastian Klimek, Anne Richter gen Kemmermann, Martina Hofmann, and Johannes Isselstein. "Plant species richness and composition in managed grasslands: the relative importance of field management and environmental factors." *Biological Conservation* 134, no. 4 (2007): 559-570.

⁸⁸ Vaclav Smil. *Enriching the Earth: Fritz Haber, Carl Bosch, and the Transformation of World Food Production* (Cambridge: MIT Press, 2001); Hugh S. Gorman. *The story of N: a social history of the nitrogen cycle and the challenge of sustainability* (New Brunswick: Rutgers University Press, 2013).

chemicals and nitrogen is being added to ecosystems faster than it can be removed by denitrifying bacteria.⁸⁹

This had led to a number of issues, highlighting the ways in which local decisions can have global impacts. The most visible consequence has been changes to water quality, with water systems worldwide suffering from excessive nutrient loading, termed eutrophication. These nutrients encourage the explosive growth of aquatic plants, like algae. The decomposition of these algae by bacteria consumes large quantities of dissolved oxygen in the water, leading to low-dissolved oxygen conditions, termed hypoxia, and even the absence of dissolved oxygen, termed anoxia. This can lead to “dead zones” in which many species are incapable of surviving. Those unable to migrate out become part of massive fish kills, images that make international headlines, though a number of animals beyond fish can suffer losses. The Gulf of Mexico suffers a dead zone of approximately six thousand square miles each spring.⁹⁰ Estimates suggest that the number of dead zones near coasts have reached 500, an increase from fewer than 50 in 1950. Since then, the area of oceanic dead zones has also risen by millions of square kilometers, an area approximately equivalent in size to the EU.⁹¹ Additionally, due to differences in animals’ ability to withstand low levels of oxygen, these conditions can alter species’ movement and therefore affect predator-prey interactions, thus further disrupting the energy flow of entire ecological communities.⁹²

⁸⁹ Smil. *Enriching the Earth*; Gorman. *The story of N*; Philip Conford. *The origins of the organic movement* (Edinburgh: Floris Books, 2001).

⁹⁰ Gorman. *The story of N*.

⁹¹ Damian Carrington. “Oceans suffocating as huge dead zones quadruple since 1950, scientists warn.” *The Guardian*. January 4, 2018, <https://www.theguardian.com/environment/2018/jan/04/oceans-suffocating-dead-zones-oxygen-starved>.

⁹² Kathryn Lang, “Hypoxia as a mediator of food web interactions and energy flow in reservoir ecosystems,” B.S. thesis, (Ohio State University, 2012).

Scholars like Gorman therefore emphasize the importance of considering ecologically-based limits, like nitrogen levels, in economic decisions. His work argues that this is an adaptive and inclusive process, which must include public participation, meaning that “unless mechanisms for making sustainability-related decisions are woven into the fabric of society, there is no guarantee that commitment to those issues will survive from one generation of leaders to the next.”⁹³ This logic applies to the whole of machair management, not simply the promotion of organic fertilizers. While government legislation and subsidies are vital, these are nonetheless subject to change. Conservation therefore must blend with local knowledge and culture, as well as with national sentiments, in order to become engrained and truly lasting, across different interest groups. As one scholar has put it, “conservation can only be achieved by consent, not decree.”⁹⁴

Of course, with the growth of artificial fertilizers has come the growth of the organic movement as well, in which many crofters have always been involved to some extent. Some may think of increasing environmentalism in the 1970s as the beginning of the organic movement, or perhaps the 1990s after the advent of genetically modified organisms (GMOs). However, historian Philip Conford traces the trend back over a century in his work *The Origins of the Organic Movement*. Fundamental throughout the movement’s history is the idea of the Rule of Return, in which organic matter taken from the soil should eventually be returned to produce enriching humus, a concept not promoted in monoculture and chemically enhanced agriculture, which are thought to exhaust the soil. Further injury was induced by the fact that, particularly following the repeal of the Corn Laws, free trade agreement allowed the importation of cheap foreign produce in exchange for British manufactured goods, thus reducing support for

⁹³ Gorman. *The story of N*, 170.

⁹⁴ Angus. “Dé tha cearr air a’mhachaire?” 60.

high quality British produce. Although artificial fertilizer usage was fairly minimal before the 1940s, organicists had formed a fairly cohesive movement by the 1920s, though the 1930s and 40s were the most formative years.

These early years were primarily focused on health, the worry being that food could be devitalized, the nutrients stripped from it, when grown improperly. Healthy soil meant healthy plants, which meant healthy humans. The idea that a synthetic chemical was adequate nourishment for plants was seen as simply the foolish notion of the “laboratory hermit.”⁹⁵ Sir Albert Howard was one of the strongest proponents of this idea, stating in his 1947 book *The Soil and Health*, disease “is the punishment meted out by Mother Earth for adopting methods of agriculture which are not in accordance with Nature’s law of return.”⁹⁶ The health of soil, plants, animals, and humans is therefore one connected chain and the disruption of this through modern agriculture has “largely cancelled out all the advantages we have gained from our improvements in hygiene, in housing, and our medical discoveries.”⁹⁷ The war years, however, helped to undermine the organic movement. While war had encouraged local, homegrown food temporarily, it had also encouraged synthetic chemical production and industrial-scale agriculture, which was viewed as having saved the nation.⁹⁸

C.S. Orwin, a supporter of modern agricultural systems admired the efficiency of modern machines and believed that “any policy encouraging [family farms and smallholdings] was merely sentimental.”⁹⁹ Of course, despite Orwin’s condescension, smallholdings have persisted in crofting regions and although modern techniques like silage and artificial fertilizers have begun to creep into traditional agriculture, crofters have nonetheless profited from this historic

⁹⁵ Conford. *The origins of the organic movement*, 39.

⁹⁶ Sir Albert Howard. *The soil and health: a study of organic agriculture* (Oxford: Oxford City Press, 2011), 1.

⁹⁷ Howard. *The soil and health*, 14.

⁹⁸ Conford. *The origins of the organic movement*.

⁹⁹ Conford. *The origins of the organic movement*, 33.

desire for high-quality and healthy food. The Scottish Crofting Foundation, the recent predecessor of today's Scottish Crofting Federation (SCF), emerged as part of a perceived "need to encourage and promote, productive, sustainable and diverse use of croft land, allowing crofters to capitalise on the well-known social and environmental benefits of the crofting system."¹⁰⁰ By the early 2000s, the Scottish Crofting Foundation promoted practices to encourage diversification, such as EU rural development schemes, Forestry Commission-supported tree planting, ecotourism, and traditional practices like common grazing.¹⁰¹ A large part of this entailed focusing on "low external input, organic, high quality, healthy, fair trade, environmentally friendly" products like honey, organic vegetables, meat, and hand-made garments, using native-breed species.¹⁰² By 2009, the SCF had established the Scottish Crofting Produce mark, an icon to assure the consumer that by purchasing these items they "will not only receive the best quality, natural food, but will be supporting the unique heritage and culture of Scottish crofting and helping to preserve some of the nation's most valued landscapes and habitats, such as the heather hills of the Highlands and the machair of the Hebrides."¹⁰³

Machair Livestock

Rotational crop cultivation that incorporates fallow fields and seaweed, such as that seen in the Outer Hebrides, allows for ideal development of machair and supports a wide range of

¹⁰⁰ Scottish Crofting Foundation. Sustainable Croft Land Use Programme. Year 1 Report, June 2005 – May 2006. GD281/145/50, Scottish Crofting Foundation, National Records, Edinburgh, Scotland.

¹⁰¹ This focus was a result of the Crofter Forestry Act of 1991, which enabled crofters to plant woodland. One such crofter, in Ardvourlie, on the Isle of Harris, had planted 110 hectares of former sheep pasture using a mixture of native trees. His croft was therefore transformed into a woodland park for local residents and tourists. See: Scottish Crofting Foundation. Pilot Rural Innovation Mentoring Scheme. End of Year Report to Carnegie UK Trust, ca. 2006, GD281/145/50, Scottish Crofting Foundation, National Records, Edinburgh, Scotland.

¹⁰² Scottish Crofting Foundation. "Concept Note. Marketing feasibility study for croft income generation. Annex 3." 2004. GD281/145/50, Scottish Crofting Foundation, National Records, Edinburgh, Scotland.

¹⁰³ "Scottish Crofting Produce: Highlands and Islands Croft Origin." Scottish Crofting Federation, accessed November 13, 2017, <http://www.crofting.org/scpbrand>.

dependent species. But livestock presence, particular that of cattle, also plays an important role. First, these animals, which traditionally have access to the grassland during the winter months, provide manure that aids in the formation of rich humus in the soil, benefiting vegetation and dependent animals. This dung can also help hide the nesting sites of birds, which have been known to utilize hoof prints for shelter as well. While the advantage depends on management strategies, cattle are considered more favorable than sheep because they are less selective during grazing. This tendency has been known to maintain a diverse range of vegetation, rather than allowing one species to dominate.¹⁰⁴ Stomping of livestock feet has also been noted to create a number of different microclimates for invertebrates, similarly to grazing, which creates varying vegetation heights on a micro-level.¹⁰⁵

Encouraging grazing for environmental reasons may seem counterintuitive, particularly given the blame placed upon livestock farming for events like the Dust Bowl. However, when carefully managed, the benefit of livestock feeding upon grassland is evident not only for machair, but for other systems as well. While tropical rainforests are considered the most biodiverse areas for vegetation on a large-scale, when looking at small-scale sections, temperate grasslands managed by grazing, mowing, or fire are some of the most diverse habitats for vascular plants in the entire world because the constant disturbance prevents competitive exclusion by species that would otherwise be dominant.¹⁰⁶ Much work has been conducted on calcareous grassland in Germany and Scandinavia.¹⁰⁷ While the initial removal of livestock can benefit vegetation, studies suggest that long-term biodiversity is actually higher within semi-

¹⁰⁴ Love. *Machair*. Stewart. *The Outer Hebrides*.

¹⁰⁵ McCracken. "Machair invertebrates: the importance of 'mosaicness'."

¹⁰⁶ Small-scale was defined as less than or equal to 50 square meters; J. Bastow Wilson, Robert K. Peet, Jürgen Dengler, and Meelis Pärtel. "Plant species richness: the world records." *Journal of Vegetation Science* 23 (2012): 796-802.

¹⁰⁷ This refers to vegetation growing upon chalk or limestone.

natural, grazed grassland than abandoned grassland.¹⁰⁸ This is confirmed to be the case with machair as well, where an abandonment of grazing can lead to particular species out-competing others and dominating, such as red fescue (*Festuca rubra*).¹⁰⁹

As well as sharing similar benefits from grazing, machair and European calcareous grasslands face similar changes. Declines in grasslands have been noted throughout Europe, where haymaking and traditional livestock rearing have become largely uneconomical. In fact, within a Swedish study, the area of grazed grassland studied dropped by 80% between 1960 and 1990.¹¹⁰ Likewise, the amount of calcareous grassland grazed by sheep in the UK in 1984 was 20% the pre-WWII figure.¹¹¹ The decline of traditional practices in livestock rearing, which can lead to the abandonment of grasslands, could also be worsened by the recent reduction in cattle and sheep numbers.¹¹² Not only could this affect grazing patterns on machair, but it could also impact the Scottish livestock industry as a whole, given that crofting regions produce high quality animals that are then transferred to Lowland farms.¹¹³ It is convenient then that livestock agriculture and machair conservation collide. In sum, cattle presence in particular provides a triple benefit for machair. First, their need for food encourages the cultivation of cereal crops in

¹⁰⁸ Matthias Dolek and Adi Geyer. "Conserving biodiversity on calcareous grasslands in the Franconian Jura by grazing: a comprehensive approach." *Biological Conservation* 104, no. 3 (2002): 351-360; Sebastian Klimek, Anne Richter gen Kemmermann, Martina Hofmann, and Johannes Isselstein. "Plant species richness and composition in managed grasslands: the relative importance of field management and environmental factors." *Biological Conservation* 134, no. 4 (2007): 559-570; Peter Poschlod and Michiel F. WallisDeVries. "The historical and socioeconomic perspective of calcareous grasslands—lessons from the distant and recent past." *Biological Conservation* 104, no. 3 (2002): 361-376; Mikas Luoto, Juha Pykälä, and Mikko Kuussaari. "Decline of landscape-scale habitat and species diversity after the end of cattle grazing." *Journal for Nature Conservation* 11, no. 3 (2003): 171-178; Regina Lindborg, Jan Bengtsson, Åke Berg, Sara A. O. Cousins, Ove Eriksson, Tomas Gustafsson, Knut Per Hasund, Lisette Lenior, Aina Pihlgren, Erik Sjödin, and Marie Stenseke. "A landscape perspective on conservation of semi-natural grasslands." *Agriculture, Ecosystems, and Environment* 125 (2008): 213-222.

¹⁰⁹ Stewart Angus and David Maclellan. "The management of offshore islands for nature conservation." *Journal of Coastal Conservation* 19, no. 6 (2015): 885-896.

¹¹⁰ Luoto et. al. *Journal for Nature Conservation* (2003).

¹¹¹ The Wildlife Trusts. "Lowland Calcareous Grassland." Accessed October 26, 2017, <http://www.wildlifetrusts.org/wildlife/habitats/lowland-calcareous-grassland>.

¹¹² Committee of Inquiry on Crofting. *Crofting Inquiry Final Report*. Edinburgh: RR Donnelley, 2008.

¹¹³ Committee of Inquiry on Crofting. *Crofting Inquiry Final Report*.

the summer to later act as winter fodder, providing shelter and forage for a number of agriculturally-linked species like the corncrake. Second, cattle grazing directly promotes biodiversity in machair vegetation and invertebrates. Finally, cattle manure acts to fertilize the soil, as well as support animals like birds.

Ironically, however, a reduction in livestock populations has not prevented the problem of overgrazing. Intensive livestock disturbance can reduce vegetation to the point of exposing bare ground, which destabilizes machair systems already prone to wind and wave erosion and allows for the colonization of species like ragwort, which can be poisonous to cattle.¹¹⁴ The landscape is especially susceptible to this when crofters permit grazing during the summer months. Although unrestricted access to machair grasslands is not encouraged in traditional management, it is nonetheless not a new problem. A 1957 article, for instance, noted overgrazing throughout the island of Tiree, which had led to a destabilization of the sandy soil.¹¹⁵ Overgrazing by sheep has most recently been linked to declining machair quality surrounding Calgary Bay on the Isle of Mull, an area designated as a Site of Special Scientific Interest. Part of this move, however, appears to be linked to the fact that a lack of available labor, due to declining income and growing career possibilities elsewhere, has made it difficult to keep sheep on hill grazings, as has been done historically.¹¹⁶

The issue of overgrazing has been quite contentious, given that sheep are now a characteristic and well-loved feature of the Scottish countryside, despite their prominent role in

¹¹⁴ Love. *Machair*; A. Cooper, T. McCann, and E. Ballard. "The effects of livestock grazing and recreation on Irish machair grassland vegetation." *Plant Ecology* 181, no. 2 (2005): 255-267.

¹¹⁵ P.B. Vose, H. Grace Powell, Jean B. Spence. "The machair grazings of Tiree, Inner Hebrides." *Transactions of the Botanical Society of Edinburgh* 37, no. 2 (1957): 89-110.

¹¹⁶ Redpath et. al. *Glasgow Natural History Society*; Doody. *Sand Dune Conservation, Management and Restoration*; Evans and Potts. *Friends of the Earth*; Moira Kerr. *The Times*. "Blooming hell: machair munched by Mull's sheep." March 25, 2017. <https://www.thetimes.co.uk/article/blooming-hell-machair-munched-by-mulls-sheep-s7fjw6ss2>; Committee of Inquiry on Crofting. *Crofting Inquiry Final Report*.

displacing farmers during the Clearances. A detailed history of the impact of sheep farming can be found in Robert Dodgshon's *No Stone Unturned*.¹¹⁷ One of the counties most affected was Sutherland, in the very north of Scotland. There, land formerly farmed in communal parcels was converted to vast sheep farms, up to 100,000 acres in size, and tenants were pushed to marginal, unfavorable land along the coast. Sheep numbers in the county increased from 15,000 in 1811 to 130,000 in 1820, the vast majority of which were Cheviots, the favored sheep breed in the 19th century. In Knoydart, on Scotland's West Coast, there was nearly complete expulsion of smallholders and cottars, many of whom were sent to Canada. The worst Hebridean Clearances occurred around 1850, when almost all of Barra, Mingulay, and parts of Uist were cleared for sheep. These former tenants suffered quite remarkably, given that the region was still recovering from the Potato Famine and little effort was made to rehome these farmers. The lack of connection between landlords and tenants here was made worse by the fact that by 1844 almost all were mainland lairds, rather than locals. In total, T. M. Devine estimates that by 1850, 60% of the large estates in the Highlands and Islands, with the exception of Sutherland, had transferred to new owners, the majority of whom were not from the region. Instability in the Highlands and Islands was therefore rampant, evident in Ramasaig, on the Isle of Skye, where communal runrig farming was converted to a crofting township, then cleared for sheep farming, then reorganized back into crofts, then once again cleared for sheep. Coastal townships were transformed through the creation of crofts to accommodate this flood of farmers, the presumption being that these immigrants could just naturally transition to become crofter-fishermen.¹¹⁸

¹¹⁷ R. A. Dodgshon. *No Stone Unturned: A History of Farming, Landscape and Environment in the Scottish Highlands and Islands* (Edinburgh: Edinburgh University Press, 2015).

¹¹⁸ Dodgshon. *No Stone Unturned*; J. B. Caird. "The making of the Scottish rural landscape." *The Scottish Geographical Magazine* 80, no. 2 (1964): 72-80.

The emergence of intensive sheep farming was part of a wider movement of “improvement” in agricultural Britain, the sentiments of which are still felt today given the rarity of traditionally managed grassland, a fact that makes machair crofting so highly valued. After the Jacobite Rebellions of 1715 and 1745 were squashed and military roads into the Highlands were constructed, Scotland began to be viewed as a safer space, somewhere worthy of investment. Throughout the 18th and 19th centuries, agricultural infrastructure was transformed to increase productivity, as seemingly “wasted” land like moorland and heathland was reclaimed for sheep pasture.¹¹⁹ Certain scholars have gone as far as to interpret this forceful interest in resource exploitation as a form of internal colonization of the Highlands by elites, often born outside of local communities.¹²⁰ Beyond the social devastation of these improvement projects, came drastic changes to the landscape through drainage, clearance, and grazing and intensifying production goals. Improvement also took the form of manipulating animals, with intensive breeding to perfect livestock breeds and the introduction of exotic domesticated breeds and wildlife as part of man’s “mission to possess and subdue the earth.”¹²¹ Many societies emerged in Britain to further this mission, such as the Society for the Importation of Foreign Seeds and Plants in mid-18th century, the Highland Society of Edinburgh in 1784 (later renamed the Highland Society of Scotland in 1787), the Zoological Society of London in 1826, and the

¹¹⁹ Dodgshon. *No Stone Unturned*; J.B. Caird, “The Reshaped Agricultural Landscape,” in *The Making of the Scottish Countryside*, eds. M. L. Parry and T. R. Slater (London: Croom Helm, 1980); T.M. Devine *Clanship to Crofter’s War: The Social Transformation of the Scottish Highlands* (Manchester: Manchester University Press, 1994).

¹²⁰ Fredrik Albritton Jonsson, *Enlightenment’s Frontier* (New Haven: Yale University Press, 2013).

¹²¹ David Esdaile. *Contributions to Natural History, Chiefly in Relation to the Food of the People, by a Rural D.D* (Edinburgh: William Blackwood and Sons, 1865) 338; a history of livestock breeding can be seen in Margaret E. Derry. *Bred for Perfection: Shorthorn Cattle, Collies, and Arabian Horses Since 1800* (Baltimore: The Johns Hopkins University Press, 2003).

Acclimatisation Society in 1860.¹²² This movement can be viewed in light of general Enlightenment ideals of improvement, growth, and progress applied to the natural world, a sentiment captured by Thomas Jefferson who claimed “the greatest service which can be rendered to any country is to add a useful plant to its culture.”¹²³

The current problem of overgrazing, largely due to sheep, therefore connects to a painful historical legacy. Some have condemned current sheep farming, such as George Monbiot, a famous proponent of rewilding landscapes in Britain, a movement whose goal is to bring back features of Scotland’s historical landscape by reintroducing woodland and locally extinct animals. To Monbiot, widespread, subsidized sheep farming “is a slow-burning ecological disaster, which has done more damage to the living systems of this country than either climate change or industrial pollution.”¹²⁴ Although overgrazing is a recognized problem, Monbiot’s intense condemnation of and desire to move away from subsidized sheep-farming has been met with heavy criticism as well. Nick Fenwick, director of agricultural policy in the Farmer’s Union of Wales, views Monbiot as part of a group of environmentalists who are “oblivious to the fact that their new-found paradise is already occupied by people whose connection with the land is deep rooted, dates back thousands of years, and is embedded in their language and culture.”¹²⁵ To Fenwick, Monbiot’s ideas of rewilding Britain ignores the ecological significance of

¹²² *Prize-Essays and Transactions of the Highland Society of Scotland* (Edinburgh: William Blackwood and Sons, 1829-1865); Thomas Veltre, “Menageries, Metaphors, and Meanings,” in *New Worlds, New Animals: From Menagerie to Zoological Park in the Nineteenth Century*, eds. R.J. Hoage and William A. Deiss (Baltimore: The Johns Hopkins University Press, 1996); Harriet Ritvo. “Going Forth and Multiplying: Animal Acclimatization and Invasion.” *Environmental History* 17, no. 5 (2012): 404-414.

¹²³ J.R. McNeill. *Something New Under the Sun: An Environmental History of the Twentieth-Century World* (New York: W.W. Norton & Company, 2000).

¹²⁴ George Monbiot. *Feral: rewilding the land, the sea, and human life* (Chicago: University of Chicago Press, 2014).

¹²⁵ Nick Fenwick. “Don’t twist reality to create the wild Wales of English romantic myth.” *The Guardian*, June 26, 2013.

agricultural sites “in order to create the wild Wales of English romantic myth.”¹²⁶ While this particular debate was sparked by Monbiot’s experiences in Wales specifically, rural land is commonly the site of conflict between different interest groups – local residents and farmers, conservationists, government entities, developers, tourism operators – hence there have been extensive efforts to create partnerships in the case of machair. It is also worth noting the impact that grazing by wildlife, both native and introduced, can have on machair landscapes and their characteristic fauna. Greylag geese, barnacle geese, and rabbits, for instance, have faced resentment and control schemes because of their tendency to feed upon crops or disturb machair vegetation.¹²⁷

Machair Climate

One final and growing threat is that of climate change. The Hebridean coastline is largely low-lying and attention has been focused on the future of islands like the Uists, the coasts of which often sit less than five meters above sea level. Rising sea levels and storm surges are therefore grave concerns for these shorelines, as they increase coastal flooding and cause salination of the water table. The average annual sea level rise between 1997 and 2002 was already 5.7 mm, meaning that sea level in the year 2100 could be nearly two feet higher than that in 2000. This presents an issue not only for natural features like coastal lochs, but also for agricultural fields, which may face flooding that prevents cropping and threatens the very survival of coastal crofts. Wildlife could likewise be affected by excessive infiltration of

¹²⁶ Fenwick. “Don’t twist reality to create the wild Wales of English romantic myth.”

¹²⁷ Kelly Finlay. “Call for renewed goose scheme funding” *The Scottish Farmer*. September 24, 2017; Machair Life+. “Home.” Machairlife..org.uk. <http://www.machairlife.org.uk/> (accessed September 7, 2017); *The Scottish Farmer*. “Barnacle geese blitz the machair.” August 6, 2017; “News Release: Crofters accuse Scottish government of environmental neglect.” Scottish Crofting Federation, November 28, 2017, <http://crofting.org/uploads/news/envneglect.pdf>; I. Newton and R. H. Kerbes. “Breeding of graylag geese (*Anser anser*) on the Outer Hebrides, Scotland.” *Journal of Animal Ecology* 43, no. 3 (1974): 771-783.

saltwater into saline lagoons, which would transform into marine habitat unsuitable for the diverse array of species that these lagoons support. The expected warmer winters and wetter summers could also affect the timing of spring ploughing and autumn harvesting, which could impact wildlife that follow precise seasonal calendars for processes like flowering and breeding.¹²⁸

As well as gradual, chronic threats, climate change is expected to impact storm activity on an already unpredictable coastline. The reality of such a threat was deeply felt in January 2005 when a storm hit the Hebrides, with winds upwards of 146.3 mph and onshore waves of 2.5 meters recorded.¹²⁹ Tragically, five members of a South Uist family were killed in the flooding: a couple, their two young children, and the children's grandfather. In addition to this acute personal loss for the community, damage to public infrastructure was estimated at £15-20 million and homes and crofts faced heavy damages. Murdo Mackenzie, who became Chairman of the Middle District Action Group to lobby for better coastal defense, said that the beach was as effective as "a wall of confetti" in protecting the island. If another storm were to hit, Mackenzie fears that "we would be looking at another St Kilda. The island's unique eco-system and the heartland of Gaelic culture would disappear."¹³⁰ Notably, Mackenzie recalls the fate of St Kilda, a once inhabited island that has since been abandoned to the birds, an indication of how strongly historic events are remembered in this region. The aftermath of the storm also highlighted the legacy of historical marginalization of the area. A civil engineer whose home was damaged in the storm claimed there was "an overwhelming feeling in these remote areas that the politicians

¹²⁸ Stewart Angus. "The implications of climate change for coastal habitats in the Uists, Outer Hebrides." *Ocean & Coastal Management* 94 (2014): 38-43.

¹²⁹ Stewart Angus and Alistair Rennie. "An Ataireachd Aird: the storm of January 2005 in the Uists, Scotland." *Ocean and Coastal Management* 94 (2014): 22-29.

¹³⁰ Lorna Martin. "The day the sea rose up and took my family away." *The Guardian*. November 5, 2005, <https://www.theguardian.com/environment/2005/nov/06/weather.scottishparliament>.

would prefer it if we simply packed up our bags and moved,” yet he stressed that, “we’re not going to. This is our home.”¹³¹ Uisdean Robertson, a local councilor, likewise suggested, “if this had happened in the south of England it would have been declared a national disaster.”¹³²

Of course, it is not just South Uist that fears encroachment by the sea. Most of the Uists, Benbecula, as well as other parts of the Hebrides are considered Potentially Vulnerable Areas for flooding – areas that support valuable machair coastlines. Approximately 50 km² of environmentally designated areas are considered at medium to high risk, as are sixteen ancient and prehistoric sites, a priority of the Scottish Coastal Archeology and the Problem of Erosion (SCOPE) Trust. As well as environmental and archeological impact, the economic consequences must be considered, with annual flooding in Benbecula, South Uist, and Barra currently costing £577,000, 65% of which is damage to residential properties.¹³³

Crofting Communities and Transformations

In sum, machair must face agricultural transformations in cultivation and livestock patterns, “natural” yet human-induced threats like climate change and introduced rabbits, and disruptive activities like recreation and development. It is essential then to consider why some of these transformations have been occurring, a question that can be addressed first by looking at depopulation, a process that to some is reminiscent of the changes experienced during the mass emigrations of the 19th century. There was considerable worry regarding population declines in the Highlands in the mid-20th century, the same time that the Taylor Commission investigated

¹³¹ Martin. “The day the sea rose up and took my family away.”

¹³² Peter Ross. “Tragedy on South Uist: the storm that swept a family away.” *The Guardian*. October 10, 2015. <https://www.theguardian.com/lifeandstyle/2015/oct/10/south-uist-storm-tragedy-10-years-on-peter-ross>.

¹³³ Comhairle nan Eilean Siar. “Section 3: Main catchments, coastal areas & surface water management within Outer Hebrides local plan district,” accessed February 6, 2018, <https://www.cne-siar.gov.uk/committees/transportation/agendas/H%20Item%208D%20Appendix%203C%20Coastal%20Flooding%20South%20Uist%20Benbecula%20and%20Barra.pdf>.

the condition of crofting and confirmed the nation's continuing need for it. The years 1911 through 1951 witnessed population declines throughout the Highlands, particularly severe in crofting counties. The nation as a whole, however, saw positive change, with the exception of 1921-1931. The only areas to see growth in the Highlands were cities (between 1931 and 1951), contrasted with the northern and western Highland countryside, which saw comparatively massive losses. Declines reached 35% in certain parishes in the Western Isles. The areas that suffered the fewest declines were those with substantial work to supplement crofting, such as forestry and hydroelectric schemes, indicating the continued historical importance of pluralism in employment for Highland and Island populations.¹³⁴

As of 2017, there were 20,566 crofts registered with the Crofting Commission and just over a quarter of these were owned by crofters themselves.¹³⁵ While this represents an increase from the 17,700 registered in the 1990s, the demographics of these crofters highlight a concerning reality about the future of crofting.¹³⁶ According to the Crofting Commission's figures, nearly 89% of crofters are aged 41 or over.¹³⁷ Unsurprisingly, the loss of young people in crofting communities is a commonly repeated concern among older generations.¹³⁸ The challenges of hard labor, physical remoteness, low profits, dependency on subsidies, and the need for multiple occupations have caused much of the depopulation witnessed in crofting communities, as well as the appeal of amenities offered in more developed areas. Demographic

¹³⁴ F. D. N. Spaven. "Decline and stability in Highlands areas." *Planning Outlook* 3, no. 2 (1953): 5-22, <http://www-tandfonline-com.proxy.lib.ohio-state.edu/doi/pdf/10.1080/09640565308730542?needAccess=true>.

¹³⁵ Crofting Commission. "Facts and Figures." <http://www.crofting.scotland.gov.uk/facts-and-figures> (accessed September 27, 2017).

¹³⁶ Bella Bathurst. "Folk who live on the edge." *The Independent*. May 14, 1994. <http://www.independent.co.uk/arts-entertainment/folk-who-live-on-the-edge-the-highland-crofter-is-traditionally-a-long-suffering-victim-of-1436227.html>.

¹³⁷ Crofting Commission. "Facts and Figures." <http://www.crofting.scotland.gov.uk/facts-and-figures> (accessed September 27, 2017).

¹³⁸ Taigh Chearsabhagh. "Machair Life+ Conserving Scottish Machair – A' Dion Machraichean na H'Alba." Vimeo video, 14:24. Posted [2014]. <https://vimeo.com/87293384>.

concerns within crofting communities can also be connected to wider trends. The Eilean Siar Council District, made up of the Outer Hebrides, witnessed a reduction from approximately 30,000 residents in 1989 to approximately 27,000 in 2017, despite the national population increasing in this period. Migration records, detailed in table 1 below, show that there is a net loss each year due to the out-migration of young people. Unsurprisingly, the number of people aged 16 to 29 is only 13.1%, lower than the national number of 18.2%, while the number of people aged 60 and over is 31.5%, higher than the national number of 24.2%.¹³⁹ The Argyll and Bute area, which encompasses the Inner Hebrides and part of the western coast, has seen similar trends. The population has declined from approximately 94,000 in 1989 to approximately 87,000 in 2017. The percentages of people aged 16-29 and aged 60 and over were likewise more extreme than national numbers, at 14.8% and 31.9%, respectively.¹⁴⁰ While other council districts have seen declines, including cities like Glasgow and Dundee, crofting communities in particular feel the losses because of fears that an entire way of life and the associated cultural, economic, and environmental benefits could disappear.¹⁴¹

Eilean Siar		Argyll and Bute	
Age Group	Net Movement/Year	Age Group	Net Movement/Year
0-15	8	0-15	44
16-29	-101	16-29	-337
30-44	26	30-44	38
45-64	31	45-64	140
65+	10	65+	-62
Total	-26	Total	-177

Table 1. Net migration in number of people per year. A negative number indicates out-migration while a positive number indicates in-migration.

¹³⁹ "Eilean Siar Council Area – Demographic Factsheet." National Records of Scotland, accessed November 30, 2017, <https://www.nrscotland.gov.uk/files/statistics/council-area-data-sheets/eilean-siar-factsheet.pdf>.

¹⁴⁰ "Argyll and Bute Council Area – Demographic Factsheet." National Records of Scotland, accessed November 30, 2017, <https://www.nrscotland.gov.uk/files/statistics/council-area-data-sheets/argyll-and-bute-factsheet.pdf>.

¹⁴¹ All council area demographics available through "Council Area Profiles." National Records of Scotland, accessed November 30, 2017, <https://www.nrscotland.gov.uk/statistics-and-data/statistics/stats-at-a-glance/council-area-profiles>.

Yet, action has also been taken to encourage farming among the younger generation. For instance, the University of the Highlands and Islands (UHI), composed of multiple branch campuses, was established in the 1990s. Among the many disciplines available to retain and revitalize Highland and Island culture, such as Gaelic studies, this institution teaches practical agricultural skills. In fact, a two-year course entirely dedicated to crofting, supported by the National Trust for Scotland, was developed by the UHI's West Highland College and offered to students in Plockton High School, on Scotland's west coast.¹⁴² Plockton was the location used for filming the fictional TV series *Hamish Macbeth*, which centers on the comedic events, as well as challenges, of a tight-knit, rural community. The SCF has also taken action to encourage crofting among younger generations, organizing the "Young Crofters: 20:20" conference in Assynt in 2015, the result of which was the addition of a Young Crofters branch to the SCF. A video produced from the gathering highlighted the reasons why young people are interested in crofting, such as the sense of community, "the link crofting creates between people and the land," and the fact that it is simply "in your blood, it's what you do."¹⁴³ While an interest in agriculture certainly played a role, the responses of young people portrayed crofting as a way of life and a unique culture and community. A former president of the SCF went so far as to say that, "crofting is nothing to do with farming...crofting is a key cultural facet that we need to push," thus rejecting the idea of a "crofters committee" in the National Farmers' Union (NFU) of

¹⁴² University of the Highland and Islands West Highland College. "New crofting course launched in high school." <https://www.whc.uhi.ac.uk/news/new-crofting-course-launched-in-high-school> (accessed September 27, 2017).

¹⁴³ Scottish Crofting Federation. "Crofting's New Voices." Vimeo video, 14:19. Posted [June 16, 2015]. <https://vimeo.com/130894951>.

Scotland.¹⁴⁴ These sentiments reflect the feelings of Alasdair Maclean decades earlier, who described crofting as “a way of life, not a business.”¹⁴⁵

Given the evident demographic concerns, the Committee of Inquiry on Crofting, appointed by Scottish Ministers, released a report in 2008 reviewing the reasons behind crofting declines and suggesting changes needed.¹⁴⁶ While the crofting world did not unanimously receive the report positively, it was nonetheless praised for its inclusion of crofting voices taken from written evidence and public meetings.¹⁴⁷ Chairman of the committee Prof. Mark Shucksmith suggested in his foreword that crofting is even more important in the 21st century than it was when reviewed in the 1954 report produced by the Taylor Committee. “The national interest today demands much more from the countryside than the post-war imperative of expanding food production. Scotland requires a well-populated countryside which sustains a diverse and innovative economy, attracts visitors, cares for natural habitats, biodiversity and carbon stocks, and sustains distinctive cultures.”¹⁴⁸ The focus of this report was local empowerment, believing that with proper external support, crofters could lead economically and environmentally sustainable lives.

Yet, this report also exposed a number of factors that have led to the abandonment of traditional practices among crofters, emigration to non-crofting areas, and a lack of young people within these communities, all of which threaten the survival of machair. One major issue that has contributed to migration and population decline is the difficulty of obtaining a croft. A

¹⁴⁴ The NFU has, however, taken the stance that crofters and farmers are “stronger together”: “Crofters and NFUS: Stronger Together.” NFU Scotland (accessed December 6, 2017), <https://www.nfus.org.uk/userfiles/images/Join%20NFUS/Crofter%20Membership/Crofting%202017.pdf>.

¹⁴⁵ Maclean. *Night Falls on Ardnamurchan*, 113.

¹⁴⁶ Committee of Inquiry on Crofting. *Crofting Inquiry Final Report*.

¹⁴⁷ Scottish Crofting Foundation. *The Crofter*. “Committee of Inquiry on Crofting final report.” August, 2008, http://www.crofting.org/uploads/crofter_journal/Crofter-80.pdf.

¹⁴⁸ Committee of Inquiry on Crofting. *Crofting Inquiry Final Report*, 1.

woman who attended the SCF's conference for young crofters complained that even at a mid-range income, she was entirely priced out of the market. A young man repeated her concerns, saying he felt "disheartened" by the price of crofts around Inverness, which remained "sky-high."¹⁴⁹ Connected to this has been the lack of affordable housing, which was cited as a concern among 88% of respondents to a public survey. While the Croft House Grant Scheme has offered aid, the Committee felt it inadequate, particularly for low-income crofters not wishing to decroft their holding in order to obtain a loan. Another issue that has strained the social networks of crofting communities is the prevalence of absentee owners. Nearly 1,800 of all registered crofts at the time of the report were listed as absentee, which in Barra represented 16.2% of all crofts. Some blame the EU subsidy system, under the Common Agricultural Policy, for this. By the 1990s, subsidy payments were decoupled from production levels, meaning that payments were not dependent on actively working crofts. The impact of this was made clear in a public meeting in Broadford, on the Isle of Skye, where it was noted that in a village containing eighteen crofts, none had been actively worked in over twenty years and only two or three were actually inhabited by village residents.¹⁵⁰ The challenges of high house prices and absentee owners must remind some crofters of the struggles faced in the 19th century, before the 1886 Crofting Act emerged. In response, the SCF has lobbied to require private individuals to sell their land if it is considered "neglected or misused."¹⁵¹

¹⁴⁹ Scottish Crofting Federation. "Crofting's New Voices." Vimeo video, 14:19. Posted [June 16, 2015]. <https://vimeo.com/130894951>.

¹⁵⁰ Committee of Inquiry on Crofting. *Crofting Inquiry Final Report*.

¹⁵¹ Scottish Crofting Federation. "News Release: Small units of land are at the heart of 'common good' says Crofting Federation." August 18, 2015. <http://www.crofting.org/uploads/news/small-units.pdf>.

Highland and Island Schemes

Because machair is dependent on the continuance of traditional agriculture, its protection is largely fuelled by schemes to promote the viability of crofting itself, many of which focus on the environmental services that crofting provides. These services are not lost on crofters, who have branded themselves as “the original environmentalists.”¹⁵² The Scottish Crofting Foundation suggested that crofters have “a long-term understanding of sustainable land use” and have made commitments to the environment, such as significant collaborations with the RSPB since the early 1990s, which were “considered groundbreaking at the time.”¹⁵³ Integral to this argument has been promoting variety in land use and supporting biodiversity, all while recognizing the communities that contribute to these habitats, given that some may “view the crofting counties as one of Europe’s last wilderness areas without appreciating the part the human population has in maintaining the landscape.”¹⁵⁴ This claim to agricultural environmentalism has continued to play a strong role in representations of crofters, as Russell Smith, Chair of the SCF, argues that supporting agriculture in the Highlands and Islands is vital due to the “public goods it provides, including preservation of the landscape, environmental protection, economic activity, population retention and quality food production.”¹⁵⁵ Notably, the environmental benefits are listed before societal ones.

There are a number of initiatives that have encouraged crofters to focus on these environmental benefits of traditional practices, thus simultaneously preserving heritage *and* habitats. This approach is particularly significant given that the vast majority of Scotland’s

¹⁵² Scottish Crofting Foundation. Pilot Rural Innovation Mentoring Scheme, End of Year Report to Carnegie Trust, ca. 2006. GD281/145/50, Scottish Crofting Foundation, National Records, Edinburgh, Scotland.

¹⁵³ Scottish Crofting Foundation. “Sustainable Croft Land Programme,” ca. 2004-2006, GD281/145/50, Scottish Crofting Foundation, National Records, Edinburgh, Scotland.

¹⁵⁴ Scottish Crofting Foundation. “Sustainable Croft Land Programme,”

¹⁵⁵ “News Release: There are opportunities for crofting agriculture and rural development post-Brexit says Federation.” *Scottish Crofting Federation*, last modified October 3, 2017, <http://www.crofting.org/news>.

countryside is considered “Less Favoured Area” in agricultural terms.¹⁵⁶ Larger forces have, of course, influenced this agri-environmental emphasis. For instance, part of the historic 1992 Rio Earth Summit was the Convention on Biological Diversity. An agreement, signed by 159 governments, emerged from this, stating the need to:

- Establish protected areas to conserve biological diversity whilst promoting environmentally sound development around these areas
- Rehabilitate and restore degraded ecosystems and to promote the recovery of threatened species in collaboration with local residents
- Respect, preserve and maintain traditional knowledge of the sustainable use of biological diversity with the involvement of indigenous peoples and local communities.¹⁵⁷

The concept of including local and traditional knowledge aligns with the Earth Summit’s broader focus on both environmental sustainability and social welfare.

It was within this climate, of promoting both biodiversity and local traditions, that the Environmentally Sensitive Areas (ESAs) scheme emerged as part of the Agriculture Act 1986. This program gave the Secretary of the State of Scotland the power to designate ESAs as a way to “encourage conservation friendly farming” by both preventing damage from intensive agriculture and financially incentivizing environmental protection and restoration.¹⁵⁸ Farmers and crofters within these schemes received a flat payment, based on the type and amount of their land, as well as variable subsidies based on conservation work being implemented. The machair on the Outer Hebridean Islands of the Uists, Benbecula, Barra, and Vatersay, estimated at about 7,500 hectares, were one of the first areas in Scotland to be included within the scheme, chosen as an ESA in 1988.¹⁵⁹ At the time of designation, about 600 crofts existed within this area. Just as today, the conservation value of this land was premised upon the range of wildflowers and

¹⁵⁶ Department of Agriculture and Fisheries for Scotland. *Environmentally Sensitive Areas in Scotland: A First Report*. Edinburgh: Scottish Office, 1989.

¹⁵⁷ Alasdair Reid. “SPICe briefing: Biodiversity.” The Scottish Parliament, 2007.
<http://www.parliament.scot/Research%20briefings%20and%20fact%20sheets/SB07-24.pdf>.

¹⁵⁸ Department of Agriculture and Fisheries for Scotland. *Environmentally Sensitive Areas in Scotland*, 4.

¹⁵⁹ Equivalent to 29 square miles

birds like breeding waders and corncrakes, though invertebrates were not mentioned. The objectives were to a) limit modern agricultural practices like artificial fertilizers and early cutting of hay and silage, b) promote traditional practices like seaweed fertilization and rotational cropping, c) prevent land improvement projects like reseedling, which could alter existing vegetation patterns, and d) protect machair from erosion and water-logging.¹⁶⁰

By 1998, around 1.4 million hectares of land, about 22% of Scotland's total agricultural and common grazings holdings, had been designated as ESAs.¹⁶¹ Evaluations of ESA effectiveness during 1998 showed sufficient maintenance of land including machair, though little noticeable enhancement, as well as the repair and maintenance of thousands of historic and archeological features. These also showed general agreement by both residents and visitors that ESAs were worth the cost, given the public benefit of these spaces.¹⁶² Public attitude therefore appears to align with that of crofting and conservation organizations, with an RSPB representative arguing that, "the principle of 'public money for public goods' should guide any future rural policy. Farmers and crofters should be financially supported using public funds for delivering the things that are valued as a society but not paid for by the market, including a thriving natural environment, and vibrant rural communities."¹⁶³ As of 2009, ten ESAs were still operating, though applications for new ESAs had ceased by 2000 and the features of this scheme

¹⁶⁰ Department of Agriculture and Fisheries for Scotland. *Environmentally Sensitive Areas in Scotland*

¹⁶¹ Equivalent to 5,400 square miles, slightly smaller than the size of the state of Connecticut. Nick Hanley, Douglas MacMillan, Robert Wright, Craig Bullock, Ian Simpson, Dave Parsisson, and Bob Crabtree. "Contingent valuation versus choice experiments: estimating the benefits of Environmentally Sensitive Areas in Scotland." *Journal of Agricultural Economics* 49, no. 1 (1998): 1-15; "Agricultural land use in Scotland," *Scottish Government*, last modified July 11, 2017, <http://www.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/agritopics/LandUseAll>.

¹⁶² Robert Crabtree and John Milne. "Applications of actions for environmentally sensitive areas: examples in Scotland." *Ann. Zootech.* 47 (1998): 491-496.

¹⁶³ Barrett. "Scottish corncrake numbers fall to lowest level since 2003."

were instead incorporated into the succeeding rural development schemes.¹⁶⁴ Notably, a 2014 study that examined changes in machair between 1976 and 2010 discovered positive changes in areas that had been part of ESA schemes, providing supportive evidence for financial incentive programs.¹⁶⁵

In addition to a growing global desire for sustainable development and agriculture, modern agri-environmental schemes also developed due to perceived deficiencies of the EU's Common Agricultural Policy system. The CAP, beginning in 1957, has been an attempt to incentivize production by paying per head of sheep for livestock owners and per hectare of land for cultivators. By the late 20th century, however, concerns grew surrounding CAP's tendency to enable damaging practices like overgrazing and fertilizer usage because payments favored large, and therefore intensive, farming. The emergence of ESAs were part of an initial effort to pay farmers to do the exact opposite and set land aside for wildlife, while still receiving payments. Similar efforts were seen in England with the Countryside Stewardship Scheme and in Wales with Tir Cymen.¹⁶⁶

¹⁶⁴ "Environmentally Sensitive Areas." *Scottish Government*, last modified October 13, 2009, <http://www.gov.scot/Topics/farmingrural/Agriculture/Environment/Agrienvironment/ESA/Introduction>.

¹⁶⁵ Rob J. Lewis, Robin J. Pakeman, Stewart Angus, and Rob. H Harris. Using compositional and functional indicators for biodiversity conservation monitoring of semi-natural grasslands in Scotland." *Biological Conservation* 175 (2014): 82-93.

¹⁶⁶ Following the ESA, the Rural Stewardship Scheme (RSS) was established in Scotland in 2001 (developed from the earlier Countryside Premium Scheme). The RSS was a voluntary program in which farmers received payments over a five-year period for managing land in a way that maintains and enhances habitats through traditional agricultural techniques. Farmland birds were of particular concern given that their populations had declined by about 40% between 1970 and 2000. The RSS was, however, perceived to favor larger farms in their selection process, which was also viewed as unnecessarily complicated. The complexity and tediousness of crofting bureaucracy in general has been a common complaint for years, requiring volunteers to help crofters with paperwork and prompting the SCF to call for simplified legislation. See: "Level 2 course: Farming and the Environment." *University of Glasgow, Dumfries Campus*, accessed November 15, 2017, <https://www.gla.ac.uk/0t4/~dumfries/files/layer2/envirostudies/rss.pdf>; Scottish Crofting Federation. "News Release: Crofting Federation calls on prospective government to deliver five actions for crofting." March 23, 2016. <http://www.crofting.org/uploads/news/fiveactions.pdf>; TheMachairman. "Cropped machair on South Uist." YouTube video, 6:54. Posted [September 9, 2010]. <https://www.youtube.com/watch?v=OJh48LInMIQ&t=2s>.

One of the most recent attempts to support sustainable agriculture was the Scotland Rural Development Programme (SRDP) 2007-2013.¹⁶⁷ The SRDP delivered benefits to farmers in several ways. The first was through rural development contracts in which farmers were assisted with and received payments for measures like planting crops and managing grassland to maintain biodiversity. Farmers also received area-based payments when living in “Less Favoured Areas” (how 85% of all Scottish agricultural land is defined), partially with the hopes of enabling traditional agriculture to persist, despite the natural disadvantages. In total, in 2007, £404 million had been allocated towards agri-environmental projects.¹⁶⁸ For instance, by March 2010, £98 million of the SRDP budget had been given to projects to stop “the loss of biodiversity and reverse previous losses,” £22 million had been given to projects that “improved carbon sequestration” in soils and woodlands, and over £3 million had been given to those that support “viable populations of rare and/or endangered species.”¹⁶⁹ Millions were awarded to projects that machair crofters could have taken part in, such as grazing management, organic farming, providing wild bird seed mix, managing grassland specifically for corn buntings and corncrakes, and managing wetland. In addition, £283,501 was awarded specifically for biodiversity cropping on in-bye land and machair. While not all agricultural holdings in areas like the Northern Isles and the Outer Hebrides are crofts or related to machair specifically, it is still worth noting the

¹⁶⁷ The SRDP 2007-2013 budget was set at £1.6 billion, with 71% financed by the Scottish Government and the remaining financed through EU funds. This was preceded by the Scottish Rural Development Plan 2000-2006 and succeeded by the Scottish Rural Development Programme 2014-2020.

¹⁶⁸ Lenny Roth. “Scotland Rural Development Programme 2007-2013.” *Scottish Parliament*, accessed November 15, 2017, <http://www.parliament.scot/Research%20briefings%20and%20fact%20sheets/SB08-34.pdf>.

¹⁶⁹ The Highland Council: Land, Environment & Sustainability Strategy Group. “Scottish Rural Development Programme (SRDP) – Progress Report.” September 30, 2010.

nearly £18 million and £5 million given to the Northern Isles and Outer Hebrides, respectively.¹⁷⁰

The most recent SRDP follows a similar model with both direct subsidies and rural development funds. For instance, 5-year payment plans are available for cropping machair. If a crofter meets the requirements, they can receive £279 per hectare per year if using manure or seaweed, an additional £222 per hectare per year for certain harvesting techniques, and £31 per hectare per year for ploughing at a shallow depth.¹⁷¹ Shallow ploughing is favored because seeds can be set within the furrow tracks and sheltered from the wind, yet the furrows are shallow enough to be held in place by the turf, preventing soil erosion.¹⁷² With money coming from both the EU and the national government, these schemes are undoubtedly top-down efforts to support both agriculture and wildlife habitats. Yet, although these schemes are often criticized as overly complex bureaucracy, this funding has nonetheless enabled voluntary bottom-up conservation by allowing crofters to maintain or revive traditional agricultural techniques, directly participate in wildlife management, and pursue occupational diversification through ventures like ecotourism. These agricultural schemes have thus contributed to the representation of crofters as “custodians of the countryside,” while enabling them to pursue the traditional practices of their ancestors for cultural reasons as well.¹⁷³ The beauty of machair is that multiple goals can overlap, with a single practice supporting crofters, wildflowers, birds, and bees.

¹⁷⁰ The Highland Council. “Scottish Rural Development Programme (SRDP) – Progress Report.”

¹⁷¹ “Machair.” *Scottish Government*, last modified September 28, 2011, <http://www.gov.scot/Topics/farmingrural/SRDP/RuralPriorities/Packages/Machair>; “Management of cropped machair.” *Scottish Government*, last modified July 6, 2009, <http://www.gov.scot/Topics/farmingrural/SRDP/RuralPriorities/Packages/Machair/Managementofcroppedmachair#top>.

¹⁷² J. W. Grant. “Cereals and grass production in Lewis and the Uists.” *Proceedings of the Royal Society of Edinburgh* 77B (1979): 527-533.

¹⁷³ Crabtree and Milne. “Applications of actions for environmentally sensitive areas: examples in Scotland,” 495.

Subsidy schemes have not been unanimously supported, though criticisms are often directed at the general subsidy system, rather than environmental crofting schemes specifically. In 2007, the Scottish Crofting Foundation expressed concerns over payment systems. It noted that payment levels varied greatly, with farmers in the western parish of Kintail receiving only £2 per hectare while farmers in the more central parish of Perth could receive up to £639 per hectare, leaving small-scale farmers on less favorable land at a competitive disadvantage, despite the greater need for support in these areas. The Crofting Foundation believed the payment system was becoming “less and less justifiable to the taxpaying public” as large, more intensive farms received the most support, which they argued “bears no relation to the delivery of public goods.”¹⁷⁴ They continued saying,

We do not believe that the British public want to see and contribute to a countryside dominated by a handful of large, intensive, industrial units of agricultural production. Small farming and crofting enterprises and those managing less productive ground or land in more remote areas provide public goods in terms of high environmental value, are important for rural development, for the social economy and for the maintenance of a culture and a way of life. Future policy should seek to ensure that the CAP, supports and maintains valuable systems that deliver numerous public goods in addition to marketable commodities.¹⁷⁵

Almost a decade later, the Chief Executive of the John Muir Trust reiterated these sentiments noting that although £3 billion was given to UK landowners and farmers in 2015, these subsidies were still paid per hectare, meaning small farms received the least amount of support.¹⁷⁶ These payments therefore continue to place crofters at a disadvantage, considering that the average size of a croft in the Uists, for instance, is only 4-6 hectares.¹⁷⁷ The SCF has also recently spoken out against the realities of payment schemes. The Scottish Government acted

¹⁷⁴ “Memorandum by the Scottish Crofting Foundation.” UK Parliament. June 11, 2007. <https://publications.parliament.uk/pa/ld200708/ldselect/ldcom/54/54we22.htm>.

¹⁷⁵ Ibid.

¹⁷⁶ Stuart Brooks. “Nature in focus: a new vision for volatile times.” *John Muir Trust Journal* 61 (2016):10-13.

¹⁷⁷ Machair Life+. “Crofting and the Machair.” 2014. <http://www.machairlife.org.uk/machair-life-crofting-booklet.pdf>.

upon a suggestion by the National Farmer's Union Scotland to create three regions for payments. The decision was made to award the best agricultural land payments of £141 per hectare, while Region 2 and 3, where crofts lie, were awarded £51 and £14 respectively. While these disadvantaged regions receive additional payments per head of sheep, the lack of a cap on payments means large sheep farms in these areas are given the competitive advantage. Mirroring their complaints in 2007, the SCF noted, "even though farmers on high quality land would, one would suppose, have a better chance of earning a living, it is deemed that they need a bigger safety net paid for by the public purse."¹⁷⁸

Scholars have also questioned subsidies on a more abstract level:

A preservation strategy can be successful in the short term, but it fails to acknowledge that traditional farming landscapes evolved as tightly coupled social-ecological systems. Traditionally, people received direct benefits from the environment, which provided a direct incentive for sustainable land use. Globalization and rural development programs increasingly alter the social subsystem in traditional farming landscapes, whereas conservation seeks to preserve the ecological subsystem. The resulting decoupling of the social-ecological system can be countered only in part by financial incentives, thus inherently limiting the usefulness of a preservation strategy. An alternative way to frame conservation policy in traditional farming landscapes is a 'transformation strategy.' This strategy acknowledges that the past cannot be preserved, and assumes that direct links between people and nature are preferable to indirect links based on incentive payments. A transformation strategy seeks to support community-led efforts to create new, direct links with nature. Such a strategy could empower rural communities to embrace sustainable development, providing a vision for the future rather than attempting to preserve the past.¹⁷⁹

The authors continue to argue that financial subsidies acknowledge the "land use link," but not the "ecosystem service link" between people and their environment, therefore ignoring the "social-ecological system as a whole."¹⁸⁰ Encouraging local empowerment is not, however, equivalent to committing fully to community-based natural resource management (CBNRM), which assumes local people will follow sustainable resource management. Instead, it is centered

¹⁷⁸ "News Release: Support to crofting agriculture." January 31, 2017.

<http://www.crofting.org/uploads/news/croftingagriculture.pdf>.

¹⁷⁹ Joern Fischer, Tibor Hartel, and Tobias Kuemmerle. "Conservation policy in traditional farming landscapes." *Conservation Letters* 5, no. 3 (2012): 167-175, 167.

¹⁸⁰ Fischer et. al. "Conservation policy in traditional farming landscapes," 171.

on creating links between people and nature, which will sometimes be new, rather than traditional.¹⁸¹ Although “traditional” management is, in fact, ideal for many aspects of machair management, such as cropping, seaweed fertilizer, hay making, and late harvests, all of which are supported by subsidies, this concept can still be applied in the sense of fostering new connections as well. A fitting example of this would be encouraging crofting tourism, in which crofters benefit directly from biodiverse land. Thus, while subsidy schemes are essential in supporting crofters’ agri-environmental initiatives, community development and empowerment is nonetheless necessary to promote and sustain true connections to landscapes like machair.

Given the centrality of the EU subsidy system to crofting, regardless of its faults, reaction to the news of Brexit was strong among some crofters. The Chair of the SCF put it simply, saying, “the impending divorce from the EU is causing a great deal of anxiety for most of Scotland and no less for crofters.”¹⁸² The SCF ended their December 2016 news releases with a short, reflective piece called “Operation Brexit: Or the Brexit Operation.”¹⁸³

We live in the shadow of Brexit. It is the great unknown, an amputation where the UK is the limb being cut off with the dream of thriving as an independent body. We don’t know how well the operation will go and what we will be post-op. We will survive, the consultants say, but will we thrive?

The SCF published a proposal for moving forward post-Brexit, though they would not reveal any political opinion regarding the decision to leave the EU. The UK Government has pledged to match funding previously provided through the EU for crofters until 2022, after which time funding will be focused on activities that “support high animal welfare and environmentally sustainable land use,” a position that the SCF supports, given crofting’s existing contribution to

¹⁸¹ Fischer et. al. “Conservation policy in traditional farming landscapes.”

¹⁸² Scottish Crofting Federation. “News Release: Crofting Federation calls on prospective government to deliver five actions for crofting.” March 23, 2016. <http://www.crofting.org/uploads/news/fiveactions.pdf>.

¹⁸³ Anon. “Operation Brexit: Or the Brexit Operation.” December 7, 2016. <http://www.crofting.org/uploads/news/brexit.pdf>.

these aims. Additionally, the organization suggests ways that support systems could be improved by emphasizing production and activity on land,¹⁸⁴ common grazings, a cap on payments to a single individual or business,¹⁸⁵ opportunities for young people and new entrants, occupational diversification beyond agriculture, affordable housing, and a recognition of the unique agricultural needs of Scotland. Brexit has prompted concerns beyond the loss of subsidies, however, thus the SCF also proposes lobbying for continued tariff free access to EU markets and freedom to employ foreign workers.¹⁸⁶

Yet, although many crofters currently depend on EU subsidies, there was no discernible difference in the way Highland and Island areas voted in the 2016 EU Referendum. While figures provided by the BBC are based on large council districts and therefore do not highlight the results from smaller regions with crofting interests, the results are still worth examining.¹⁸⁷ For instance, 44.8% of voters in the Eilean Siar (Western Isles) council district and 44% of voters in the Highland district supported leaving the EU. In comparison, these results are similar to the 44.7% of voters in Angus and 45% of voters in Aberdeenshire who supported leaving, both of which lie outside of crofting districts. The councils with the fewest “leave” votes were the City of Edinburgh (25.6%) and East Renfrewshire (25.7%) and East Dunbartonshire (28.6%), both of which neighbor the Glasgow City district.

¹⁸⁴ By specifying “activity” in addition to production, they are suggesting that it is important to also consider land usage, rather than focusing solely on financial metrics, as certain land can only support small stock numbers and therefore will not be as productive. These crofts are, nonetheless, considered valuable in environmental, social, and economic terms.

¹⁸⁵ Northern Ireland has a cap of £150,000, which the SCF deems appropriate for Scotland as well.

¹⁸⁶ “SCF Post-Brexit Position.” *Scottish Crofting Federation*, accessed November 14, 2017. <http://crofting.org/uploads/news/scfpostbrexit.pdf>.

¹⁸⁷ This lack of differentiation is significant in certain instances. For example, the “Highland” district is treated as a single entity, rather than analyzing individual regions like Caithness, Sutherland, Ross and Cromarty, and Inverness-shire. Likewise Argyll and Bute represents a single voting district, meaning votes from the Inner Hebrides cannot be distinguished from mainland votes. Taken a step further, these results evidently do not consider individual towns, thus it is not possible to determine where those centered around crofts voted differently than the council district as a whole. See: “EU Referendum: The results in maps and charts.” BBC.com, accessed Nov. 13, 2017, <http://www.bbc.com/news/uk-politics-36616028>.

Machair Schemes

The efforts above represent an effort to preserve crofting lifestyles for a combination of social, cultural, historical, and environmental reasons. There have also been schemes aimed more directly towards machair and associated animal species, though the goals of these projects often overlap with more general crofting interests, indicative of how intertwined human and wildlife communities are within these regions and a growing awareness of this fact. One of the most extensive projects was Machair Life+, a €2.3 million program which ran from 2010 to 2014 and was supported by the EU's Life+ program, which funds nature conservation, and managed by the RSPB in partnership with SNH, the SCF, and Comhairle nan Eilean Siar (CnES).¹⁸⁸ The Life+ program did not fund research projects, thus the focus was on "concrete conservation actions."¹⁸⁹ The project operated on a number of Hebridean islands including the Uists, Barra, Coll and Tiree, Oronsay and South Colonsay, Islay, and Lewis, targeting 3,200 hectares of machair.¹⁹⁰ Some of the most valuable machair, included within Special Areas of Conservation, were considered in "unfavourable declining" condition, primarily because of agricultural intensification. Machair Life+'s main objectives were thus to:

1. Expand the area of late harvested crop on arable machairs
2. Effect a reduction in the area of under-sown crop and effect an increase in area of cropped machair
3. Undertake best practice arable crop production and demonstrate these to the crofting community and govt agencies
4. Establish best practice in-bye management as part of a whole crofting biodiversity package
5. Identify constraints to management and increase the capacity to undertake beneficial management

¹⁸⁸ In English, the Western Isles Council, but the Scottish Gaelic name is used, even within an English language context.

¹⁸⁹ Paul Walton and Iain MacKenzie. "The conservation of Scottish Mahcair: a new approach addressing multiple threats simultaneously, in partnership with crofters." *The Glasgow Naturalist* 25 Supplement (2009): 25-28, <http://www.glasgownaturalhistory.org.uk/machair/conservation.pdf>, 26.

¹⁹⁰ Equivalent to 12.36 square miles

6. Expand skills and knowledge base and support the [SRDP] to deliver better management of designated site
7. Secure the supply of local arable seed¹⁹¹

The final technical report of this project evaluated their effectiveness in reaching these objectives and pointed to a number of successes, such as purchasing equipment needed to carry on these practices, including a reaper binder that allows crofters to create corn stacks in the fields for winter fodder that also benefits animals like birds who rely on the winter seeds. This is in contrast to the more modern, plastic-wrapped silage bales, which are produced by cutting the corn earlier in the season. The RSPB site manager for the Uist reserves estimates that Uist corn buntings may have lost up to 95% of their winter seed source because of this transition.¹⁹² Creating incentives to leave arable stacks to benefit corn buntings is therefore a goal that the RSPB has been working towards for years.¹⁹³ Despite efforts, questions remain whether traditional, late harvesting of the crop will continue, with Machair Life+'s report suggesting it may be an "unrealistic target."¹⁹⁴

¹⁹¹ Machair Life+. "Machair Life+ Technical Report." 2014. http://www.machairlife.org.uk/Machair_LIFE-Final_Technical_Report.pdf, 78-82.

¹⁹² Jamie Boyle. "Corn bunting on the Uists," High Nature Value Farming, accessed November 17, 2017, <http://www.highnaturevaluefarming.org.uk/hnv-in-scotland/species-story-corn-bunting-on-the-uists/>.

¹⁹³ Mentioned, for example in SCF Sustainable Crofting Land Use Programme. Year 2 Report. June 2006-May 2007. GD281/145/50, Scottish Crofting Foundation, National Records, Edinburgh, Scotland.

¹⁹⁴ Machair Life+. "Machair Life+ Technical Report," 78.



Figure 7. Traditional corn stacks © Kieren Jones

In addition to its work on Machair Life+, the RSPB has been particularly active in protecting these agricultural systems, given their importance to birds like waders, corncrakes, and corn buntings. As in Machair Life+, the charity has worked with crofters to promote the return to traditional practices like crop rotation, seaweed fertilizer, and local varieties of seeds, as well as ensuring bird-friendly techniques like late-harvested crops. One key space for this partnership is the RSPB Balranald Nature Reserve on North Uist, a 658-hectare (2.54 sq. mi) reserve established in 1966 that includes machair systems. It is managed by four crofting townships, as well as through individual management agreements with crofters. The RSPB's goal is to further develop sustainable tourism to support both the reserve and the crofters working this land and to see long-term public support for these farmers.¹⁹⁵ The importance of reserves and protected sites will be considered in greater detail in chapter three.

¹⁹⁵ "Futurescapes." *RSPB*, accessed November 15, 2017, https://www.rspb.org.uk/Images/machair_tcm9-260983.pdf.



Figure 8. Balranald Reserve, North Uist © RSPB

Concluding Remarks

There are several ways in which machair can claim distinctiveness. The species composition and environmental features of this coastal landscape exist only within a small corner of the globe. Accordingly, it is the only habitat universally recognized by a Gaelic term, highlighting its deep connection to Highland and Island culture. Furthermore, machair is a habitat whose diversity is actually supported by constant, though highly regulated, human disturbance. It is also a landscape that presents a striking image of Scotland's history, encouraging visitors to recall the traditional machinery and wildflower-dotted fields that used to stretch across Britain's countryside. Finally, machair is one of the last refuges for species like the great yellow bumblebee and the corncrake.

While machair may be distinct in many ways, the preservation of this landscape offers lessons that can be applied to almost any ecosystem. On the one hand, it is the support of government subsidies, public bodies, and environmental charities that has enabled the protection of machair habitats. However, it is crofters themselves who have also driven these movements through their skills, knowledge, and motivation to simultaneously preserve a historic way of life *and* the environment. While certain practices, like encouraging later harvesting of crops, are aimed primarily at helping wildlife, many activities like rotational cropping of the machair are

aiding the environment through the maintenance and revival of age-old practices engrained in local heritage. Thus, efforts to conserve machair and its wildlife are often inseparable from efforts to support Scotland's crofters and rural communities.

Much has changed since the youth of poet Alasdair Maclean. Remembering his time in Sanna, on the western point of the Ardnamurchan Peninsula, Maclean recalls a feature on the beach called the *Druim*, or "the Ridge." A plateau covered with machair a hundred yards wide that stretched nearly the entire length of Sanna's coast, the *Druim* attracted tourists, local children, and crofters' livestock all of whom slowly degraded the grassland. Maclean was struck by the role that local people played in the deterioration of this habitat, which he compared to the destruction of a coral reef. "Who bothered to tell us that we were demolishing something precious and irreplaceable?" he asked. "Who knew?"¹⁹⁶ Fortunately, since the disappearance of the *Druim* machair in the 1970s, this type of landscape has become treasured ground to people across Scotland and the world. While many crofters no doubt have always recognized its value, today we see partnerships that call upon traditional agriculturalists, environmental advocates and volunteers, government entities and public bodies, ecologists, and tourists to preserve this habitat and the lifestyles that support it. The study of machair therefore highlights the ways in which local history and culture matter in the conservation of the ecosystems in which we are so intertwined.

¹⁹⁶ Maclean. *Night Falls on Ardnamurchan*, 89.

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